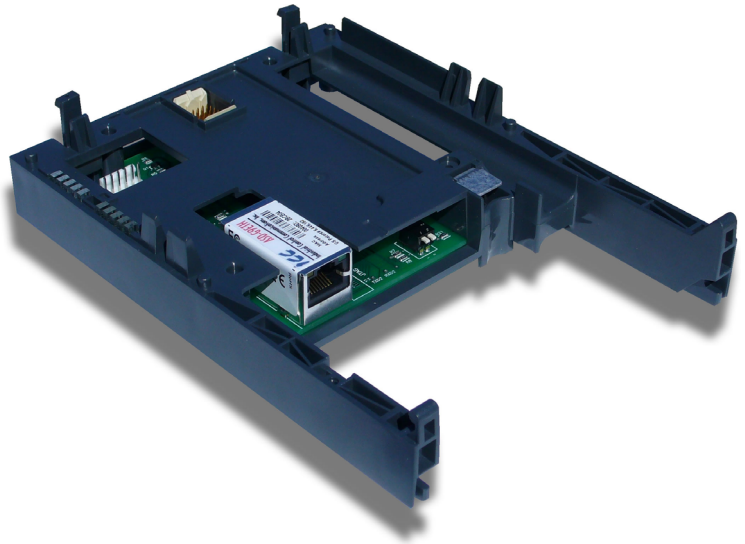
ASD INTERFACE SERIES

ICC

INDUSTRIAL CONTROL COMMUNICATIONS, INC.



ASD-G9ETH

MULTIPROTOCOL ETHERNET INTERFACE FOR TOSHIBA G9 / VFAS1 ADJUSTABLE SPEED DRIVES

July 2007
ICC #10639-0.900-000

ASD-G9ETH Multiprotocol Ethernet Interface
User's Manual

Part Number 10639-0.900-000
Printed in U.S.A.

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This user's manual may not cover all of the variations of interface applications, nor may it provide information on every possible contingency concerning installation, programming, operation, or maintenance.

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Usage Precautions

Operating Environment

- Please use the interface only when the ambient temperature of the environment into which the unit is installed is within the following specified temperature limits:

  Operation: -10 ~ +50°C (+14 ~ +122°F)
  Storage: -40 ~ +85°C (-40 ~ +185°F)
- Avoid installation locations that may be subjected to large shocks or vibrations.
- Avoid installation locations that may be subjected to rapid changes in temperature or humidity.

Installation and Wiring

- Proper ground connections are vital for both safety and signal reliability reasons. Ensure that all electrical equipment is properly grounded.
- Route all communication cables separate from high-voltage or noise-emitting cabling (such as ASD input/output power wiring).

ASD Connections

- Do not touch charged parts of the drive such as the terminal block while the drive's CHARGE lamp is lit. A charge will still be present in the drive's internal electrolytic capacitors, and therefore touching these areas may result in an electrical shock. Always turn the drive's input power supply OFF, and wait at least 5 minutes after the CHARGE lamp has gone out before connecting communication cables.
- For further drive-specific precaution, safety and installation information, please refer to the appropriate documentation supplied with your drive.
- Internal ASD EEPROMs have a limited life span of write cycles. Observe all precautions contained in this manual and your ASD manual regarding which drive registers safely may and may not be repetitively written to.

TABLE OF CONTENTS

1. Introduction

Congratulations on your purchase of the ICC Multiprotocol Ethernet Interface for the Toshiba G9 and VFAS1 families of Adjustable Speed Drives (ASDs). This interface allows information to be transferred seamlessly between the drive and several different Ethernet-based fieldbus networks with minimal configuration requirements. The interface installs directly into the drive enclosure and presents a standard 10/100BaseT Ethernet port for connection to the Ethernet network. In addition to the supported fieldbus protocols, the interface also hosts an embedded web server, which provides access to all drive information via a standard web browser for remote monitoring, configuration and control.

Before using the interface, please familiarize yourself with the product and be sure to thoroughly read the instructions and precautions contained in this manual. In addition, please make sure that this instruction manual is delivered to the end user of the interface and ASD, and keep this instruction manual in a safe place for future reference or unit inspection.

For the latest information, support software and firmware releases, please visit http://www.iccdesigns.com.

Before continuing, please take a moment to ensure that you have received all materials shipped with your kit. These items are:

- Ethernet interface in plastic housing
- Documentation CD-ROM

Note that different interface firmware versions may provide varying levels of support for the various protocols. When using this manual, therefore, always keep in mind that the firmware version running on your interface must match this manual's respective revision in order for all documented aspects to apply.

This manual will primarily be concerned with the interface board's hardware specifications, installation, wiring, configuration and operational characteristics. For more advanced ASD application-level information, please contact Toshiba's ASD Marketing Department for copies of available application notes.

To maximize the abilities of your new ASD interface, a working familiarity with this manual will be required. This manual has been prepared for the interface installer, user, and maintenance personnel. With this in mind, use this manual to develop a system familiarity before attempting to install or operate the interface or ASD.

2. Features

Ethernet Port

IEEE 802.3 10/100BaseT Ethernet compliant. Shielded RJ45 connector accepts standard CAT5-type 8-conductor unshielded twisted-pair (UTP) patch cables. Supports multiple simultaneous protocols.

Supported Protocols

The interface currently provides server support for the following fieldbus protocols:

- Modbus TCP/IP
- Ethernet/IP
- BACnet/IP
- Profinet IO

Note that use of Profinet IO is mutually exclusive of the other supported protocols. In order to use Profinet IO, a separate application firmware file must be loaded into the interface (refer to section 12).

Macromedia® Flash-Enabled Embedded Web Server

Interface configuration and real-time drive parameter monitoring & control are provided via an embedded web server. The interface's web server feature provides direct data access and control via standard web browsers such as Microsoft Internet Explorer and Netscape Navigator. The latest version of Macromedia Flash Player browser plug-in is required. Refer to section 9.

XML Configuration File Upload/Download

All interface configuration files are stored in the unit's internal filesystem in XML format. These files can be transferred to/from a PC via the FTP protocol, which provides the capability for PC-based file backup and easy configuration copying to multiple units. Configuration files can also be viewed and edited via standard text editors, XML editors and web browsers. Refer to section 11.

Field-Upgradeable

As new firmware becomes available, the interface can be upgraded in the field by the end-user. Refer to section 12 for more information.

3. Precautions and Specifications

Rotating shafts and electrical equipment can be hazardous. Installation, operation, and maintenance of the ASD and interface board shall be performed by **Qualified Personnel** only.

Qualified Personnel shall be:

- Familiar with the construction and function of the ASD and interface board, the equipment being driven, and the hazards involved.
- Trained and authorized to safely clear faults, ground and tag circuits, energize and de-energize circuits in accordance with established safety practices.
- Trained in the proper care and use of protective equipment in accordance with established safety practices.

Installation of ASD systems and associated interface boards should conform to all applicable **National Electrical Code** (NEC) *Requirements For Electrical Installation*s, all regulations of the **Occupational Safety and Health Administratio**n, and any other applicable national, regional, or industry codes and standards.

DO NOT install, operate, perform maintenance, or dispose of this equipment until you have read and understood all of the following product warnings and user directions. Failure to do so may result in equipment damage, operator injury, or death.

3.1 Installation Precautions

- Use lockout/tagout procedures on the branch circuit disconnect before installing the interface board into the ASD.
- Avoid installation in areas where vibration, heat, humidity, dust, metal particles, or high levels of electrical noise (EMI) are present.
- Do not install the ASD or interface board where it may be exposed to flammable chemicals or gasses, water, solvents, or other fluids.
- Where applicable, always ground the interface board appropriately to prevent electrical shock to personnel and to help reduce electrical noise. The ASD's input, output, and control power cables are to be run separately from the interface board's associated cables.

  Note: *Conduit is not an acceptable ground.*

- Turn the power on only after attaching the front cover.
- Follow all warnings and precautions and do not exceed equipment ratings.
- The ASD maintains a residual charge for a while after turning supply power off. After turning supply power off, wait at least ten minutes before servicing the ASD or interface board. Ensure that the **Charge LED** is off prior to beginning installation.
- For further ASD-specific precaution, safety and installation information, please refer to the applicable *Adjustable Speed Drive Operation Manual* supplied with your ASD.

3.2 Maintenance Precautions

- Use lockout/tagout procedures on the branch circuit disconnect before servicing the ASD or installed interface board.
- The ASD maintains a residual charge for a while after turning supply power off. After turning supply power off, wait at least ten minutes before servicing the ASD or interface board. Ensure that the **Charge LED** is off prior to beginning maintenance.
- **Do Not** attempt to disassemble, modify, or repair the interface board. Contact your ICC or Toshiba sales representative for repair or service information.
- Turn the power on only after attaching the front cover and **Do Not** remove the front cover of the ASD when the power is on.
- If the ASD should emit smoke or an unusual odor or sound, turn the power off immediately.
- The ASD heat sink and discharge resistors may become extremely hot to the touch. Allow the unit to cool before coming into contact or performing service on the ASD or interface board.
- The system should be inspected periodically for damaged or improperly functioning parts, cleanliness, and to determine that all connectors are tightened securely.

3.3 Inspection

Upon receipt, perform the following checks:

- Inspect the unit for shipping damage.
- Check for loose, broken, damaged or missing parts.

Report any discrepancies to your ICC or Toshiba sales representative.

3.4 Storage

- Store the device in a well ventilated location (in its shipping carton, if possible).
- Avoid storage locations with extreme temperatures, high humidity, dust, or metal particles.

3.5 Warranty

This communication interface is covered under warranty by ICC, Inc. for a period of 12 months from the date of installation, but not to exceed 18 months from the date of shipment from the factory. For further warranty or service information, please contact Industrial Control Communications, Inc. or your local distributor.

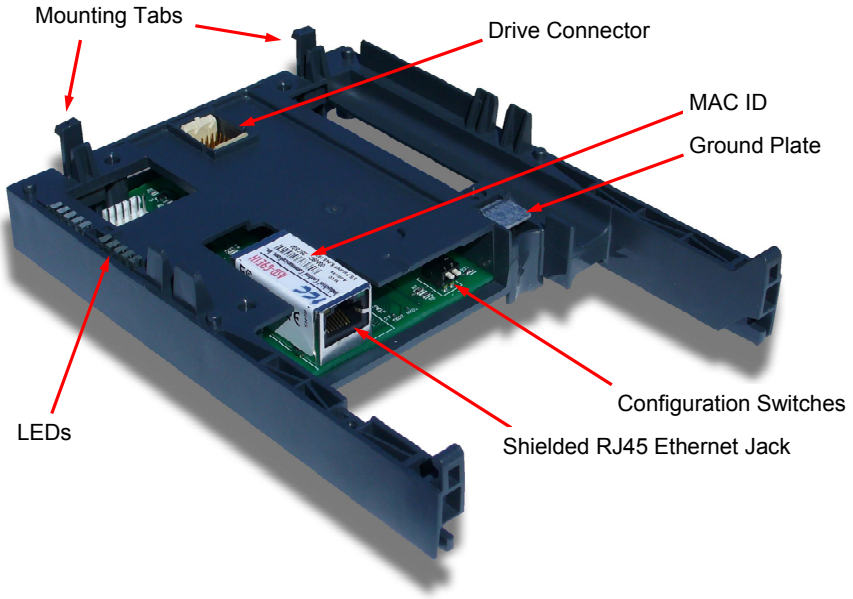
3.6 Disposal

- Contact the local or state environmental agency in your area for details on the proper disposal of electrical components and packaging.
- Do not dispose of the unit via incineration.

3.7 Environmental Specifications

Item	Specification
Operating Environment	Indoors, less than 1000m above sea level, do not expose to direct sunlight or corrosive / explosive gasses
Operating Temperature	-10 ~ +50°C (+14 ~ +122°F)
Storage Temperature	-40 ~ +85°C (-40 ~ +185°F)
Relative Humidity	20% ~ 90% (without condensation)
Vibration	5.9m/s^2 {0.6G} or less (10 ~ 55Hz)
Grounding	Non-isolated, referenced to ASD control power ground
Cooling Method	Self-cooled

4. Interface Board Overview



Note: The configuration switches are used for factory test only, and should remain in the OFF (up) position at all times.

5. Installation

This interface card has been designed for quick and simple installation. The card is connected to the drive's control board via a 30-pin rectangular connector, and is mechanically supported via an integral housing that seamlessly mates with the drive's enclosure. The only tool required for installation is a flat-blade screwdriver.

Before opening the drive, please observe all safety precautions as outlined on the drive's front cover and in the operation manual.

5.1 Installation Procedure

1. **CAUTION!** Verify that all input power sources to the drive have been turned OFF and are locked and tagged out.
2. **DANGER!** Wait at least 5 minutes for the drive's electrolytic capacitors to discharge before proceeding to the next step. **Do not touch any internal parts with power applied to the drive, or for at least 5 minutes after power to the drive has been removed. A hazard exists temporarily for electrical shock even if the source power has been removed.** Verify that the CHARGE LED has gone out before continuing the installation process.
3. Remove the drive's display panel and front cover by inserting a flat-blade screwdriver into each of the two mounting tab access openings at the top of the front cover and depressing each of the mounting tabs (Figure 1). Rotate the top of the font cover outward and remove the cover (Figure 2).

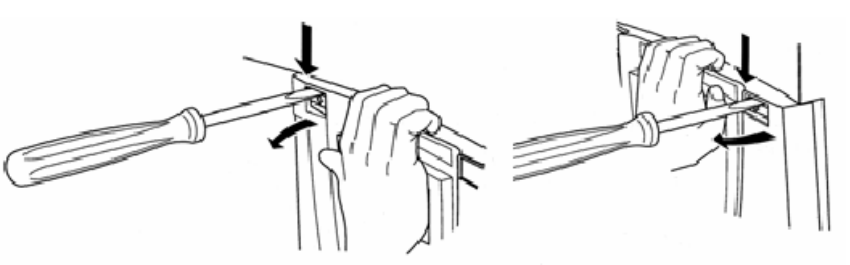


Figure 1: Releasing the Drive's Front Cover

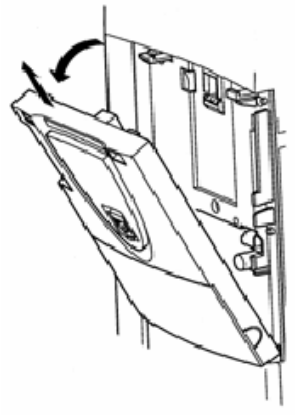


Figure 2: Removing the Drive's Front Cover

4. Install the interface card into the drive by inserting the tabs on the lower legs of the interface housing into the corresponding slots on the drive's enclosure. Rotate the interface housing up and press it onto the drive enclosure's mounting tabs, depressing firmly until the housing snaps into place (Figure 3). Double-check that the plastic bosses located on the left and right side of the drive enclosure are properly inserted into the corresponding recesses on the back of the interface housing, and that the interface housing is overall secure and flush with the drive enclosure.

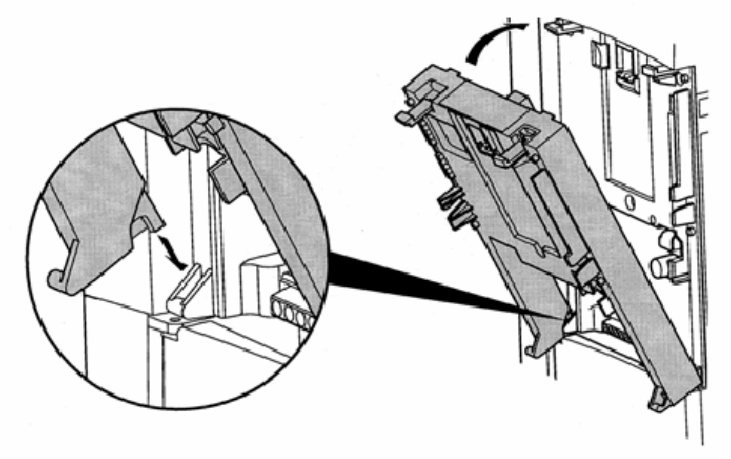


Figure 3: Installing the Interface Card

5. Reinstall the drive's front cover by inserting the tabs on the bottom part of the front cover into the corresponding slots on the interface housing. Rotate the front cover up and press it onto the interface housing's

mounting tabs, depressing firmly until the front cover snaps into place (Figure 4). Double-check that the plastic bosses located on the left and right side of the interface housing are properly inserted into the corresponding recesses on the back of the front cover, and that the front cover is overall secure and flush with the interface housing.

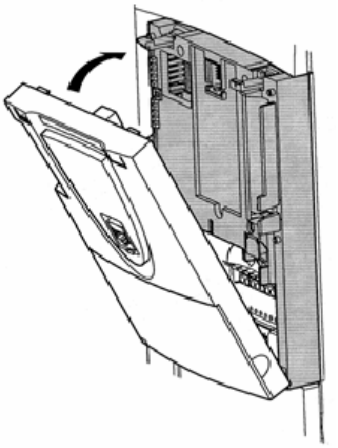


Figure 4: Reinstalling the Drive's Front Cover

6. Insert the network cable into the Ethernet jack. Ensure that the connector is fully seated into the jack, and route the cable such that it is located well away from any electrical noise sources, such as drive's input power or motor wiring. Also take care to route the cable away from any sharp edges or positions where it may be pinched.
7. Turn the power source to the drive ON, and verify that it functions properly. If the drive does not appear to power up, or does not function properly, immediately turn power OFF. **Repeat steps 1 and 2 to remove all power from the drive.** Then, verify all connections. Contact ICC or your local Toshiba representative for assistance if the problem persists.

5.2 Installing Multiple Option Cards

When this communication interface is installed into a drive in conjunction with an I/O option card, the I/O option card must be installed first (adjacent to the drive's enclosure), and the communication interface must be installed last (adjacent to the drive's front panel).

6. LED Indicators

6.1 Front Panel

The interface board has 5 bicolor (red/green) LEDs that are visible through the ASD's front cover (labeled 2.1 through 2.5).

Module Status	2.1
Reserved	2.2
Reserved	2.3
Ethernet Activity	2.4
Heartbeat	2.5

Module Status: Normally solid green during operation. If a fatal error occurs, this LED will flash a red error code. The number of sequential blinks (followed by 2s of OFF time) indicates the error code.

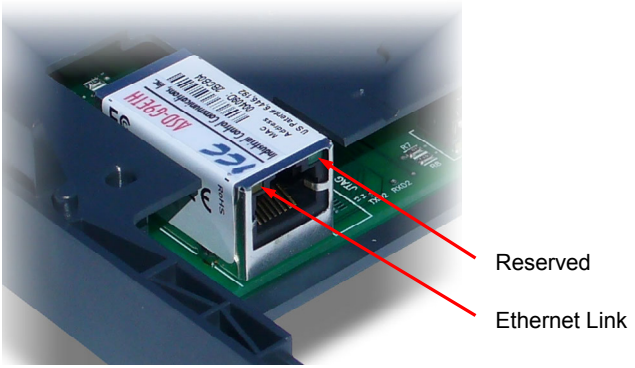
Reserved: These LEDs are currently unused and are therefore always OFF.

Ethernet Activity: Blinks green briefly when network packets are sent or received.

Heartbeat: Blinks green to indicate communication between the interface card and the drive.

6.2 Ethernet Jack

The Ethernet jack also contains two embedded LEDs.



Ethernet Link: This amber LED is lit whenever a viable Ethernet network is connected to the port.

Reserved: This green LED is currently unused and is therefore always OFF.

7. Configuring the IP Address

Before you can access the interface from your web browser or begin using it as a part of your automation network, you must know its IP address. The interface comes from the factory configured to obtain an IP address dynamically (DHCP/BOOTP). You can determine the interface's current IP address using the discovery software included on the CD provided with the interface, or available from the ICC homepage at http://www.iccdesigns.com. Additionally, G9 drives allow IP address assignment via their keypads.

7.1 Via the Finder Application

To configure the interface to use a static IP address:

1. Connect the interface to your network and apply power to the ASD. When the interface boots up, it will attempt to obtain an IP address from a DHCP server or, failing that, will fallback to a default static IP address of 192.168.16.102.
2. To determine the initial IP address of your interface, start the `ICC FINDER.EXE` discovery utility.
3. The discovery utility scans the network for ICC devices and then lists each device's **IP Address**, **MAC Address**, **Firmware Version** and **Product ID**. Identify your device by its MAC address (printed on a label on the top of the Ethernet network jack). Refer to Figure 5.

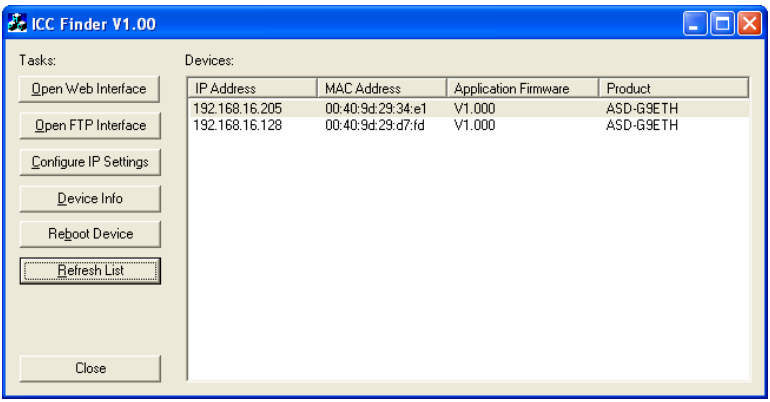


Figure 5: *ICC Finder* Discovery Utility

4. To change the IP address, select the device in the list of detected devices and click the **Configure IP Settings** button.
5. In the dialog that appears, select **Manually configure network settings**.

6. Enter the desired **IP Address**, **Subnet Mask**, **Default Gateway** and case-sensitive system password (icc) in the appropriate boxes, then click **Apply**.
7. Click **Reboot Device**. Rebooting may require 30s or more to complete. When the device status indicates “Ready”, click **Close**.
8. The discovery utility will automatically rescan the network. Confirm that the new IP address has been accepted by the device.

7.2 Via the Drive’s Keypad

This section applies to G9 drives only.

UNDER CONSTRUCTION

8. Using the ICC Finder Application

The “ICC Finder” application is a simple Windows PC program (just a single .exe file, no installations, DLL’s etc.), which when executed discovers all ICC communication interfaces on the current Ethernet subnet, regardless of whether or not their network parameters are currently compatible with the subnet upon which they reside. Refer to Figure 6.

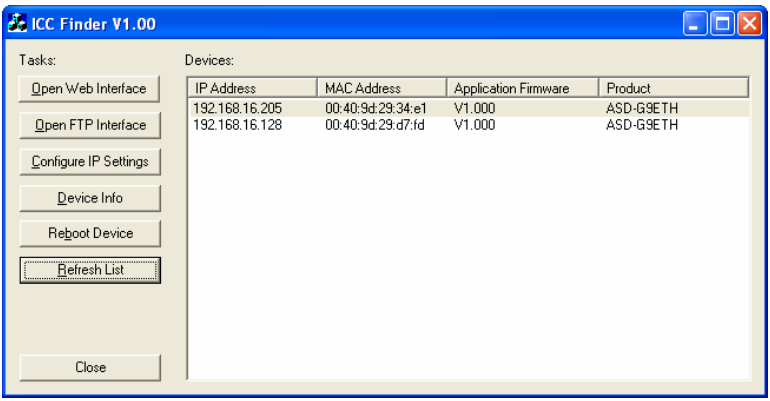


Figure 6: *ICC Finder* Discovery Utility

All discovered devices can be organized in ascending or descending order by clicking on the desired sort header (IP Address, MAC Address, Application Firmware or Product). The buttons on the left side of the window perform the following actions:

Open Web Interface: Opens a web browser page of the selected device. Refer to section 9.

Open FTP Interface: Opens the computer’s default FTP application, which could be either Windows Explorer, a web browser, or a 3rd-party FTP program (whatever the computer/operating system is configured for by default). This allows you to interact directly with the unit’s on-board flash filesystem, enabling you to drag and drop files to/from the unit and upload new firmware. Refer to section 11.

Configure IP Settings: Allows configuration of whether the device will use static IP parameters or will obtain its IP parameters via DHCP. Refer to section 7 for more information.

Device Info: Opens a dialog box containing relevant device information.

Reboot Device: Opens a dialog box which prompts for a password to reboot the interface. Enter the case-sensitive system password (icc), then click **Reboot**. The reboot cycle has completed when the displayed status changes

from “Rebooting” to “Ready” (note that this may require 30s or more to complete.) Clicking **Close** will then close the dialog box and cause the discovery utility to automatically rescan the network.

Refresh List: Causes the discovery utility to rescan the network.

Close: Closes the discovery utility.

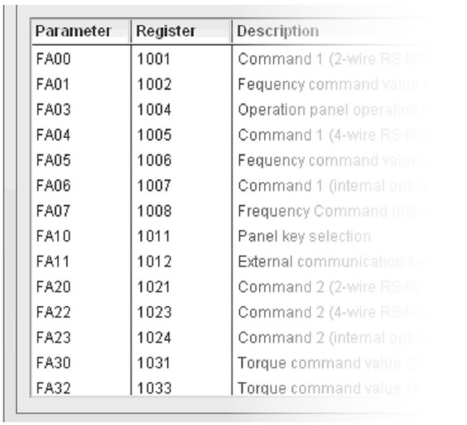
9. Parameter Numbering

Inspection of the Toshiba ASD user's manual reveals that the ASD's parameters are organized as hexadecimal numbers ranging from F000 to FFFF. These parameters are made accessible to the interface board as "registers", and are numerically remapped to present a more natural interface to the communications user. There are 1500 total registers available via the interface board, and their mappings are as shown in Table 1.

Table 1: ASD Parameter-to-Register Mapping

Hexadecimal ASD Parameter Numbers…	…Map to Decimal Register Numbers
F000 - F999	1 - 1000
FA00 - FA99	1001 - 1100
FB00 - FB99	1101 - 1200
FC00 - FC99	1201 - 1300
FD00 - FD99	1301 - 1400
FE00 - FE99	1401 - 1500

This mapping is easier to understand if one just uses the interface's web page as a guide (refer to Figure 7 and section 10.4.4). The "parameter" numbers (ASD references) and "register" numbers (network references) for all available parameters are shown in the first two columns. Commanding the drive over the network therefore entails writing to registers 1007 (option board command) and 1008 (option board frequency command), which correspond to ASD parameters FA06 and FA07, respectively.



Parameter	Register	Description
FA00	1001	Command 1 (2-wire RS4
FA01	1002	Fequency command value
FA03	1004	Operation panel operation
FA04	1005	Command 1 (4-wire RS4
FA05	1006	Fequency command value
FA06	1007	Command 1 (internal opti
FA07	1008	Frequency Command (int
FA10	1011	Panel key selection
FA11	1012	External communication fre
FA20	1021	Command 2 (2-wire RS4
FA22	1023	Command 2 (4-wire RS4
FA23	1024	Command 2 (internal opti
FA30	1031	Torque command value (2
FA32	1033	Torque command value (2

Figure 7: Web Page Register Assignment Reference

To avoid confusion, when this user's manual uses the term "parameter", it will be referring to the ASD's hexadecimal number as documented in the ASD

user's manual. Similarly, when this user's manual uses the term "register", it will be referring to the decimal number as it is exposed to the network interface.

Note that although 1500 total registers are available in the register space, not all of those registers have corresponding parameters that exist in the drive. In other words, if a read from or write to a register that does not correspond to an existing drive parameter takes place, the read/write will be successful, but the data will have no meaning. This feature is beneficial in situations where the accessing of non-contiguous registers can be made more efficient by accessing an all-inclusive block of registers (some of which correspond to drive parameters and some of which do not), while only manipulating those in your local programming that are known to exist.

10. Embedded Web Server

10.1 Overview

The interface contains an embedded web server (also known as an HTTP server), which allows users to access the drive's internal data in a graphical manner with web browsers such as Microsoft Internet Explorer or Mozilla Firefox. In this way, the drive can be monitored, configured and controlled from across the room or from across the globe.

In order to view the interface's web page, the free Adobe (formerly Macromedia) Flash Player browser plug-in is required. If the plug-in is not already installed on your computer, then your browser will automatically be redirected to the appropriate Adobe download web site when you initially attempt to access the interface's web page. Alternatively, the plug-in can be downloaded directly by going to http://www.adobe.com, and choosing the "get Adobe Flash Player" link. Always ensure that you have the latest version of the Flash Player installed: if some aspect of the web page does not appear to be displayed properly, installing the latest Flash Player update usually resolves the problem.

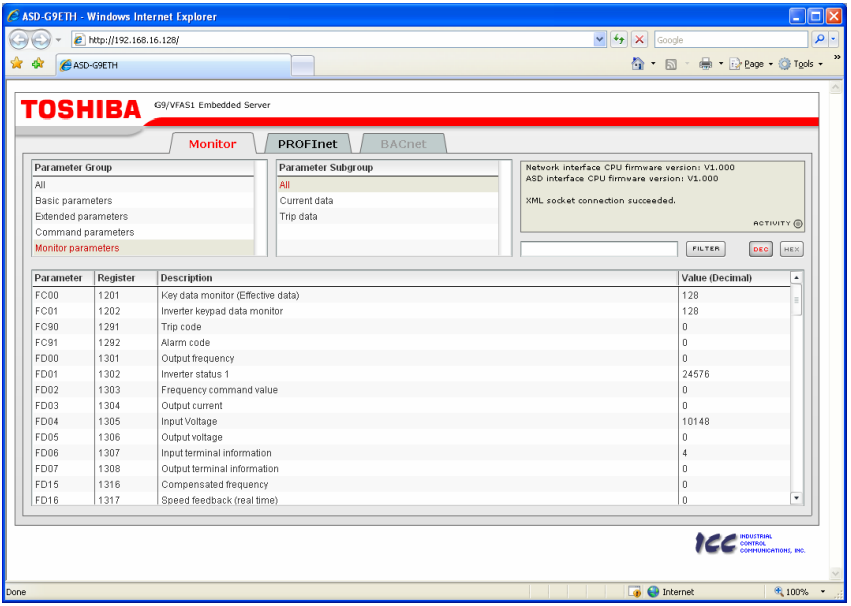


Figure 8: Embedded Web Server

To access an interface's embedded web server, either use the finder utility (refer to section 8) and select the "Open Web Interface" button when the target unit is highlighted, or just directly enter the target unit's IP address into the

address (URL) field of your web browser. Refer to Figure 8 for a representative screenshot of the web server interface.

In order to access the web server and view the parameter values, destination TCP ports 80 and 2000 must be accessible from the client computer. If an "XML socket connection failed" error message is displayed in the information window, and no parameter values are shown, this is typically indicative of port 2000 being blocked by a firewall or Ethernet router situated between the client computer and the interface card.

10.2 Authentication

For security, the interface requires valid user authentication whenever the web page is accessed. The authentication request will appear as a browser popup box that will request entry of a user name and password. Refer to Figure 9.

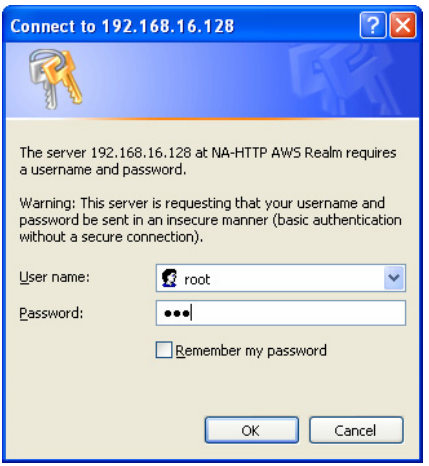


Figure 9: Web Server Authentication

The required user name is "root", and the password is "icc". Note that the username and password are case-sensitive, and that once authenticated, the authentication will remain in effect from that point until all browser windows are closed.

10.3 Page Select Tabs

The web interface is subdivided into several different "tabs" of associated information, much the same as how folders in a filing cabinet are arranged. Refer to Figure 10. To change tabs, just click on the tab you wish to view. The title of the currently-selected tab is red. Note that because different protocols

are supported by the interface with different firmware images, not all tabs may be accessible with the firmware image currently loaded. The titles of tabs that are not accessible are grayed-out, and clicking them has no effect.

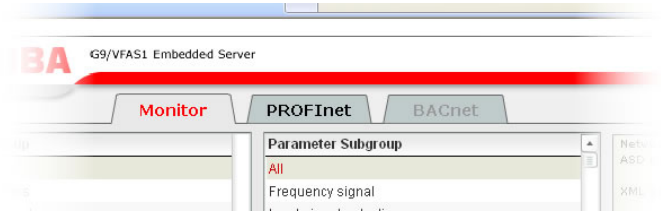


Figure 10: Page Select Tabs

10.4 Monitor Tab

10.4.1 Information Window

Figure 11 shows the Information Window, which is located in the upper-right hand corner of the monitor tab. This window displays various informational messages regarding the status of the interface card or web browser session. There is also an “activity” indicator located in the lower-right hand corner of the Information Window, which blinks periodically to show the status of data communication between the web browser and the interface card. If you do not observe the activity indicator blink at all for several seconds or more, it is possible that the web browser may have lost contact to the web server due to a drive reset or a network problem: to reestablish communications, select “refresh” on your web browser.

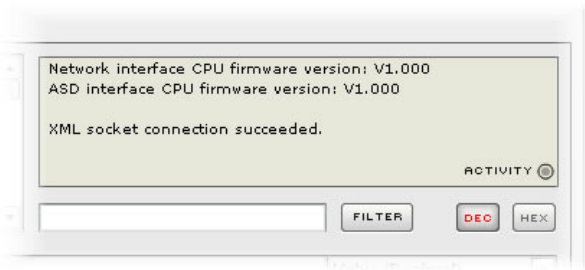


Figure 11: Monitor Tab Information Window

10.4.2 Parameter Group Selection List

The Parameter Group Selection List is located in the upper-left hand corner of the Monitor Tab. Refer to Figure 12. When a parameter group is selected, the parameter subgroups (if any) contained in that parameter group are displayed in the Parameter Subgroup Selection List (refer to section 10.4.3), and the corresponding parameters are displayed in the Parameter List (refer to section 10.4.4). The following parameter groups are available:

All: All parameters are available (configuration, command and monitor parameters).

Basic Parameters: Only the configuration parameters most commonly used for drive setup are available.

Extended Parameters: All other configuration parameters that are not “basic parameters” are available.

Command Parameters: Only drive command parameters are available. Note that although all parameters associated with drive control are available in this selection, only those parameters that are identified as being for the “internal option board” can be used to actually control the drive via the option board: all other drive command parameters can only be monitored via the option board.

Monitor Parameters: Only drive monitor parameters are available.

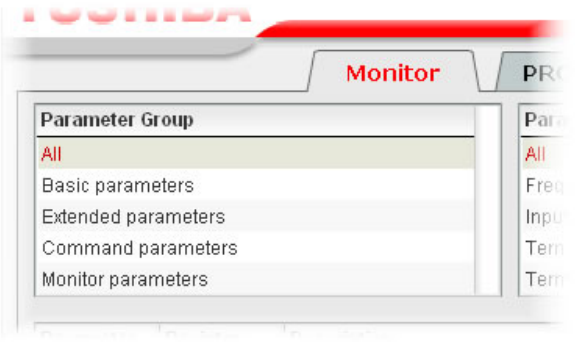


Figure 12: Parameter Group Selection List

10.4.3 Parameter Subgroup Selection List

Subgroups can be used to further filter the parameters of a group that are to be displayed in the Parameter List. Refer to Figure 13.

If the group currently selected in the Parameter Group Selection List (refer to section 10.4.2) has subgroups available, then choosing the desired subgroup will further filter the parameters that are displayed in the Parameter List. If the

currently-selected group does not have any available subgroups, then only the "All" subgroup will be shown, and all parameters in that group will be shown in the Parameter List.

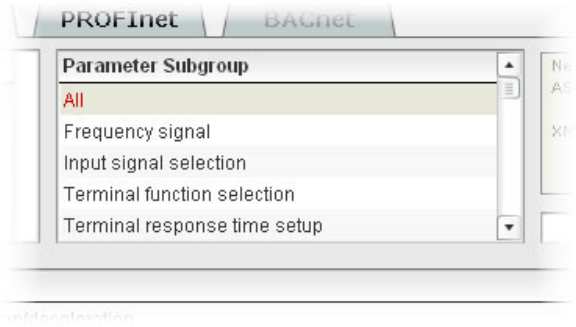


Figure 13: Parameter Subgroup Selection List

10.4.4 Parameter List

The bottom half of the Monitor tab contains the parameter list (refer to Figure 14). The parameters that are displayed in the list at any given time depend on the group/subgroup selected, as well as whether or not any filters have been applied (refer to section 10.4.5).

The first two columns of the Parameter List show the parameter name and the register number that provides access to that parameter, and were discussed in detail in section 9. The third column contains the parameter descriptions, which are used by the filter function.

The last column performs two functions: it displays the current value of the parameter, and also allows changing the parameter's value by clicking on the number in the value column and entering the new value. When entering new parameter values, be sure that the number being entered is appropriate for the currently-selected radix (refer to section 10.4.6): for example, an entered value of "1000" in hexadecimal is equal to 4096 in decimal.

Parameter	Register	Description	Value (Decimal)
AU1	1	Automatic acceleration/deceleration	0
AU2	2	Automatic torque boost	0
CMOd	4	Command mode selection	1
FMOd	5	Frequency setting mode selection 1	4
FMSL	6	FM terminal meter selection	0
FM	7	FM terminal meter adjustment	509
tyP	8	Factory default setting	0
Fr	9	Forward run/reverse selection	0
ACC	10	Acceleration time 1	178
dEC	11	Deceleration time 1	30
FH	12	Maximum frequency	8000
UL	13	Upper limit frequency	6000
LL	14	Lower limit frequency	0
vl	15	Base frequency 1	6000

Figure 14: Parameter List

10.4.5 Parameter List Filter

A filter function provides Parameter List search capabilities. To use the filter function, simply type a word or portion of a word into the filter entry box and then click the “filter” button. Refer to Figure 15.

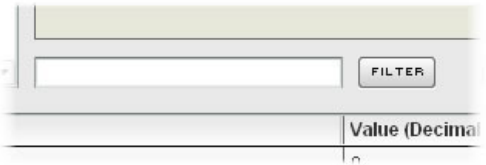


Figure 15: Parameter List Filter

The filter will then display only those parameters currently available in the Parameter List that satisfy the search criteria. For example, to find all monitor parameters that contain some derivative of the word “volt” (such as “voltage” or “volts”), select the “Monitor Parameters” group, the “All” subgroup, and then enter “volt” in the filter entry box.

Once a filter has been entered, it will continue to be applied to all information normally displayed in the Parameter List for as long as the filter term is left in the filter entry box. Continuing the previous example where we filtered on the root term “volt” in the monitor parameters, we can then easily apply this filter to all parameters (configuration, command or monitor) simply by selecting the “All” parameter group. The Parameter List will now display all configuration, command or monitor parameters that contain the root term “volt”.

To remove the filter, delete any characters contained in the filter entry box and then click the “filter” button.

10.4.6 Radix Selection

Figure 16 shows the radix selection buttons. These selection buttons allow changing the Parameter List "value" column data display and entry radix between decimal and hexadecimal formats.

Figure 16: Radix Selection

When "DEC" is selected, the "value" column heading will be "*Value (Decimal)*", current parameter values will be displayed in decimal, and values to be written to parameters must be entered in decimal format. For example, to change the drive's frequency command to 40.00Hz, enter the decimal value 4000.

Similarly, when "HEX" is selected, the "value" column heading will be "*Value (Hexadecimal)*", current parameter values will be displayed in hexadecimal, and values to be written to parameters must be entered in hexadecimal format. For example, to turn on bits #15, #14 and #10 in the drive's command word, enter the hexadecimal number C400.

10.5 Profinet Tab

This section is only applicable when the Profinet firmware is loaded onto the interface card. The Profinet tab provides for the configuration of the device on a Profinet network. Refer to Figure 17.

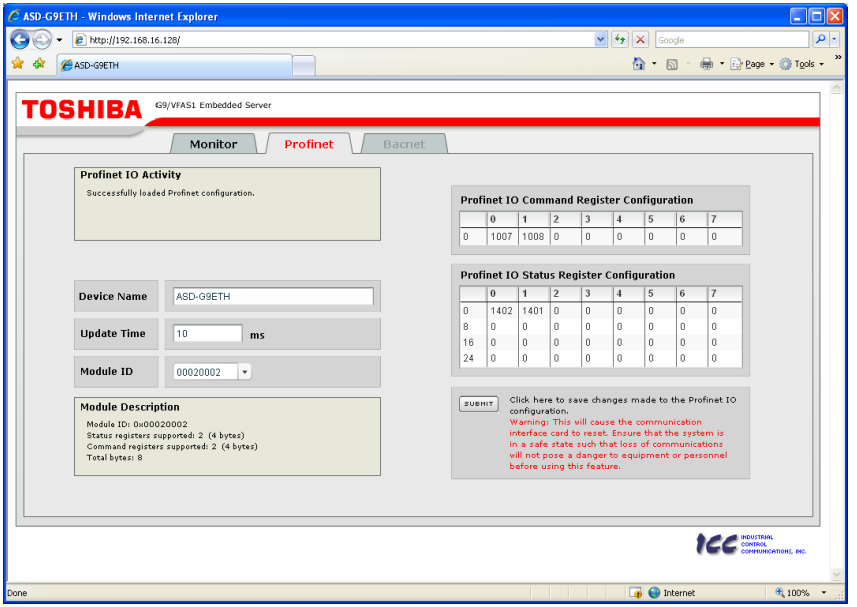


Figure 17: Profinet Tab

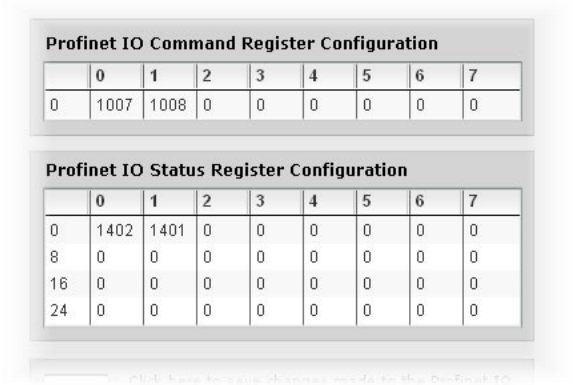
10.5.1 Information Window

Figure 18 shows the Information Window, which is located in the upper-left hand corner of the Profinet tab. This window displays various informational messages regarding the status of the Profinet configuration (loading or submitting).

Figure 18: Profinet Tab Information Window

10.5.2 I/O Data Configuration Arrays

The I/O data configuration arrays consist of two separate elements (refer to Figure 19.) The command register configuration defines the structure of the command data sent from the Profinet controller to the drive, and the status register configuration defines the structure of the status data sent from the drive back to the controller. These arrays allow the creation of custom-built I/O data. Up to 8 command registers can be sent to the drive, and up to 32 status registers can be sent back to the controller. Each box in an array is capable of containing a register number. Because all drive registers are 16-bit data elements, each box therefore represents two bytes of input or output data.



Profinet IO Command Register Configuration

	0	1	2	3	4	5	6	7
0	1007	1008	0	0	0	0	0	0

Profinet IO Status Register Configuration

	0	1	2	3	4	5	6	7
0	1402	1401	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0

Figure 19: I/O Data Configuration

The command register array locations are numbered 0-7, and traverse from left to right. The status register array locations are numbered 0-31, and traverse from left to right across each row, and then increment to the left-most position on the next row. Clicking on a box in an array allows the user to enter a register number that will be referenced at that location when data is either received from or sent to the controller. A value of 0 indicates that no register is referenced at that location, which will cause corresponding command data to be ignored and status data to be a default value of 0.

As an example, looking at the default configuration shown in Figure 19, we can see that each array contains two defined registers. Therefore, up to 4 “meaningful” bytes of data can be both received and sent (the qualifier “meaningful” is used here because the currently-selected module ID may indicate larger input and/or output data sizes, but all unreferenced command data will be ignored, and all unreferenced status data will contain dummy “0” values). The first word (two bytes) of command data will be written to register 1007 (command 1) and the second word will be written to register 1008 (frequency command). Similarly, the first word of status data will contain the value of register 1402 (status 1) and the second word will contain the value of register 1401 (output frequency).

10.5.3 Device Identification and Configuration

There are several identification and configuration items available for setting various characteristics of the Profinet device. These items are shown in Figure 20 and are explained in further detail below.

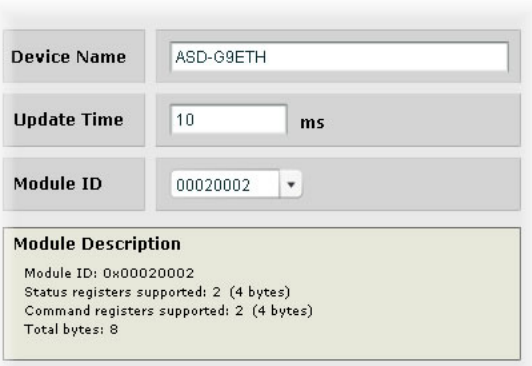


Figure 20: Profinet Device Identification and Configuration

A Profinet device's name (station name) must be unique across the entire Profinet network because it is used by controllers to uniquely identify Profinet devices. The **Device Name** text entry box is used to configure this unique device identifier on every drive.

The **Update Time** field is a configuration item which changes the frequency with which command and status data updates take place internally in the device. This setting is not related to the frequency with which data communications take place on the Ethernet network. This time setting is a 32-bit value adjustable in 1ms increments. Typically, this value should not need to be changed from its default value of 10ms.

The **Module ID** drop-down box allows the selection of the specific module which is to be used in communication with the controller. For communications to take place, the same module must be selected on both the device and the controller. The Module ID is a 32-bit number which uniquely defines a specific set of input and output data sizes. The upper half of the Module ID number specifies how many input (status) registers the drive will send to the controller, and the bottom half of the Module ID number specifies how many output (command) registers the controller will send to the drive. For example, if Module ID 00320002 is chosen, then this means that the drive will send 32 registers (64 bytes) of status information to the controller, and will be expecting the controller to send 2 registers (4 bytes) of command information to it. As a convenience, the **Module Description** window provides information about each Module ID when it is selected. All combinations of input and output sizes in 2-register increments are available, for a total of 84 possible combinations.

10.5.4 Submitting Changes

Whenever any of the Profinet configuration elements (I/O array configuration, Module ID selection etc.) have been changed, the “submit” button located in the lower right-hand portion of the web page must be clicked in order to write these settings to the interface card’s filesystem.

Note that because these configuration elements are read from the filesystem only when the interface card boots up, the act of submitting configuration changes will also reset the interface card. Please allow 30 to 60 seconds for the interface card to reboot, at which time it will then be operating with the recently-submitted configuration. Refer to Figure 21.

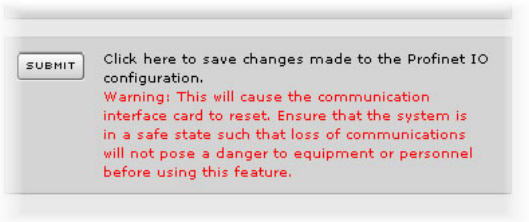


Figure 21: Submit Profinet Changes

10.6 Bacnet Tab

The Bacnet tab provides for the configuration of the device on a Bacnet/IP network. Refer to Figure 22.

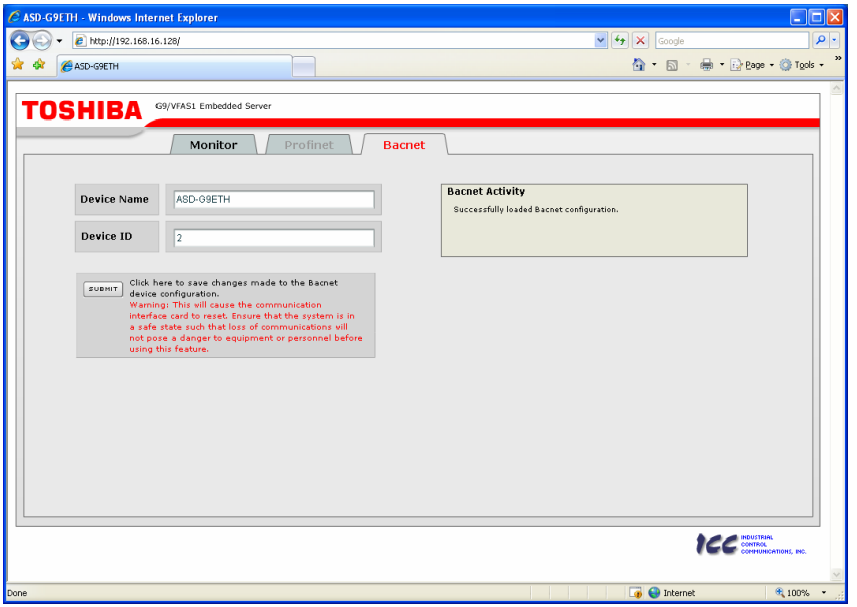


Figure 22: Bacnet Tab

10.6.1 Information Window

Figure 23 shows the Information Window, which is located in the upper-right hand corner of the Bacnet tab. This window displays various informational messages regarding the status of the Bacnet configuration (loading or submitting).

Figure 23: Bacnet Tab Information Window

10.6.2 Device Identifiers

A Bacnet device's name and ID (the Object_Name and Object_Identifier properties, respectively, of the Device Object) must be unique across the entire Bacnet network because they are used to uniquely identify Bacnet devices. The text entry boxes shown in Figure 24 are used to configure these unique device identifiers on every drive.

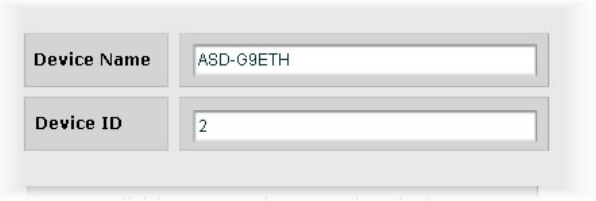


Figure 24: Bacnet Device Identifiers

10.6.3 Submitting Changes

Whenever either of the Bacnet configuration elements (Device Name or Device ID) has been changed, the "submit" button located in the left-hand portion of the web page must be clicked in order to write these settings to the interface card's filesystem.

Note that because these configuration elements are read from the filesystem only when the interface card boots up, the act of submitting configuration changes will also reset the interface card. Please allow 30 to 60 seconds for the interface card to reboot, at which time it will then be operating with the recently-submitted configuration. Refer to Figure 25.

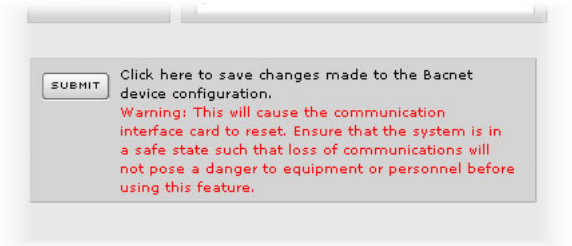


Figure 25: Submit Bacnet Changes

11. Interacting With the Filesystem

The interface card's on-board filesystem is used to store files for use by the application firmware. Currently, the application firmware's main use of the filesystem is to store XML-encoded configuration files that dictate the characteristics of the various protocols. Each protocol that requires configuration will have its own XML file stored on the filesystem. For easy identification, the filename will begin with the corresponding protocol which it configures. For example, a BACnet configuration file's filename will begin with "bacnet", and a Profinet I/O file will begin with "pnio".

Whenever the configuration for a specific protocol is completed, it is suggested that a backup copy of the configuration file be downloaded from the unit to a PC. One reason for this is in case it becomes necessary to restore a previous configuration at a later time. Another reason is that it may be desirable to load multiple units with the same configuration, as a downloaded configuration file can be uploaded again to any compatible unit, allowing the user to easily clone multiple units with the same configuration.

Each time the interface card boots up, it will interrogate the filesystem for the configuration files required by the protocols currently operating in the unit. If it does not find a required file, it will create one and initialize it with factory-default values. Therefore, if it is ever desired to reset a protocol's configuration to factory-default values, this can be easily accomplished by simply deleting the appropriate configuration file from the filesystem and rebooting the unit.

Note that the application firmware uses specific filenames for the configuration files. This means that if a file with a different filename is loaded onto the unit, it will be stored correctly, but will not be used by the application firmware. Similarly, if an existing configuration file's filename is changed, then the unit will again create a default configuration file at next boot-up, which will be stored in the filesystem alongside the file with the changed name.

Configuration files are only read by the protocol drivers at unit boot-up. Therefore, if a new configuration file is loaded onto a unit's filesystem, that unit must be rebooted for the configuration file's settings to take effect. Rebooting a unit can be performed by:

- power-cycling the drive in which the card is installed,
- setting drive parameter F899 (register 900) to a value of "1" either via the keypad, a communication protocol or the web server interface, or
- selecting the "Reboot Device" button in the Finder application.

Interacting with the filesystem is performed by use of the File Transfer Protocol (FTP). Using FTP allows the user to interact with the files on the interface card's filesystem in the same manner as though they were traditional files stored on a local or remote PC. While there are many different FTP applications available, the following sections will provide general examples of using some of the most commonly-available ones.

11.1 Initiating FTP via the Finder Utility

After discovering all interface cards on the current subnet as described in section 8, select the target interface card and then click on the “Open FTP Interface” button. This will open the computer’s default FTP application, which could be Windows Explorer, a web browser, or a 3rd-party FTP program (whatever the computer/operating system is configured for by default). This example will assume that a web browser (Microsoft Internet Explorer) is configured as the default FTP application.

An authentication dialog will appear (refer to Figure 26.) Enter the user name “root” and case-sensitive password “icc”, then click “Log On.”

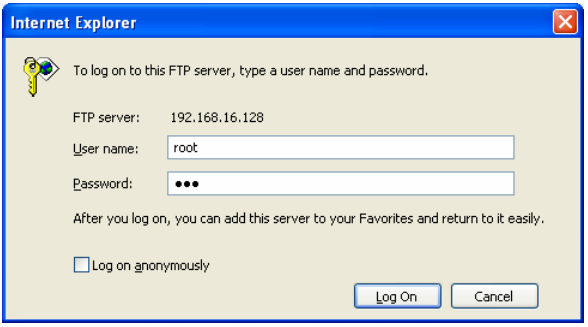


Figure 26: FTP Authentication

The web browser will then display the filesystem’s contents (refer to Figure 27.) FTP access via a web browser allows viewing and downloading files to a computer, but does not allow advanced file manipulation such as cut, paste, drag-and-drop, etc. For advanced file manipulation abilities, use of a different FTP application is required.

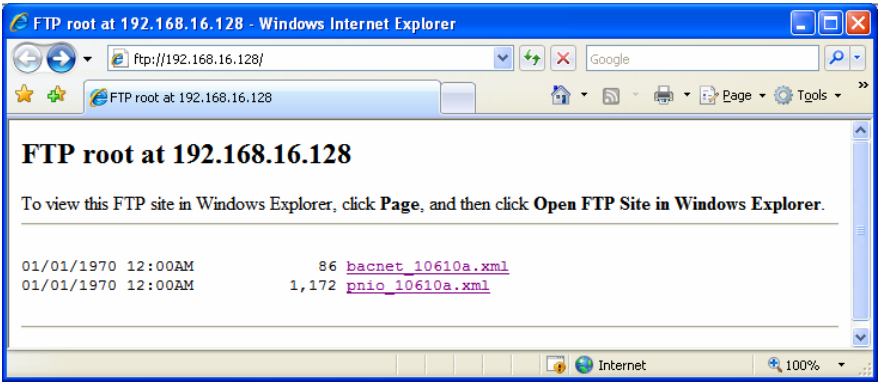


Figure 27: FTP Navigation with Internet Explorer

11.2 Using FTP with Windows Explorer

To use FTP with Microsoft Windows Explorer, first open either “Windows Explorer” or “My Computer”. Refer to Figure 28. Please note that the indicated procedure, prompts and capabilities outlined here can vary depending on such factors as the installed operating system, firewalls and service packs.

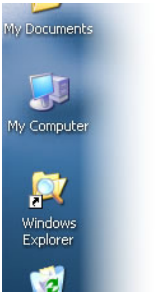


Figure 28: Accessing Windows Explorer

In the “Address” field, type in “ftp://root@” and then the IP address of the target interface card. Refer to Figure 29.

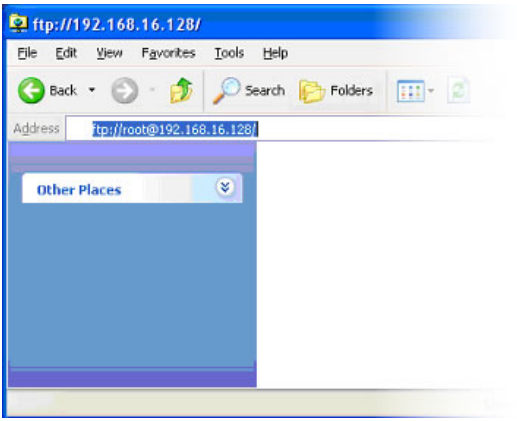


Figure 29: FTP Navigation with Windows Explorer

You will then be presented with an authentication dialog (refer to Figure 30.) The user name “root” will already be filled-in. Enter the case-sensitive password (icc) and click “Log On.”

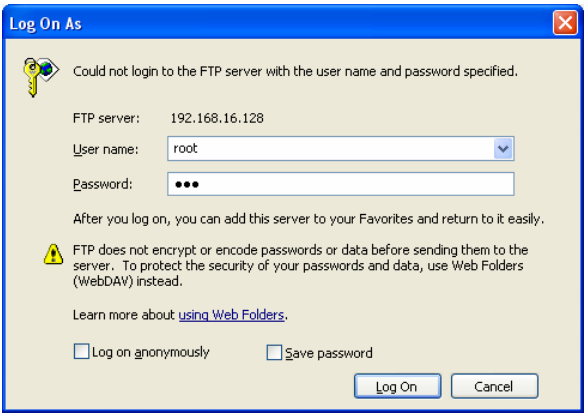


Figure 30: FTP Authentication

Windows Explorer will then display the filesystem's contents (refer to Figure 31.) You can now perform normal file manipulation actions on the available files (cut, copy, paste, open, rename, drag-and-drop transfers etc.) in the same manner as though you were manipulating any traditional file stored on your computer's hard drive.

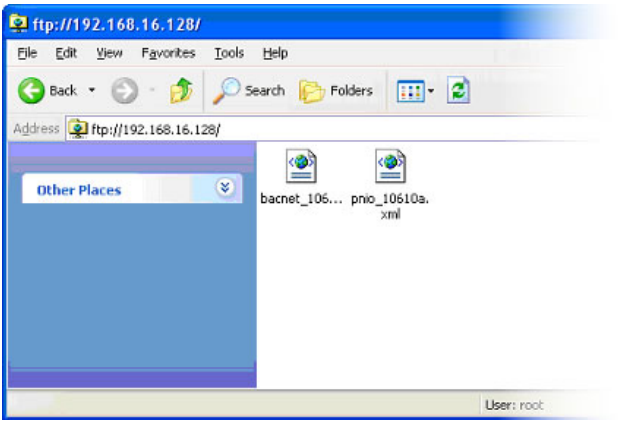


Figure 31: File Access Via Windows Explorer

11.3 Using FTP with a Windows Command Prompt

To use FTP with a Windows command (DOS) prompt, first open a command prompt by either selecting *Start…All Programs…Accessories…Command Prompt*, or by selecting *Start…Run* and typing “cmd” in the “Run” dialog.

Once the command prompt opens, type “ftp” and the IP address of the target interface card. The FTP client will connect to the unit and then prompt for a username (“root”) and case-sensitive password (“icc”). Upon successful entry of the authentication information, you will be presented with an “ftp>” prompt. Refer to Figure 32.

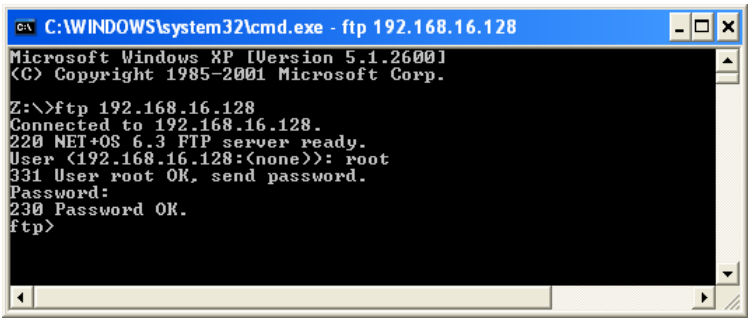


Figure 32: FTP Initiation and Authentication

At this point, you can use standard Unix-style file and directory manipulation commands to perform such actions as listing files (Figure 33), copying files to your computer (Figure 34), and copying files to the unit (Figure 35).

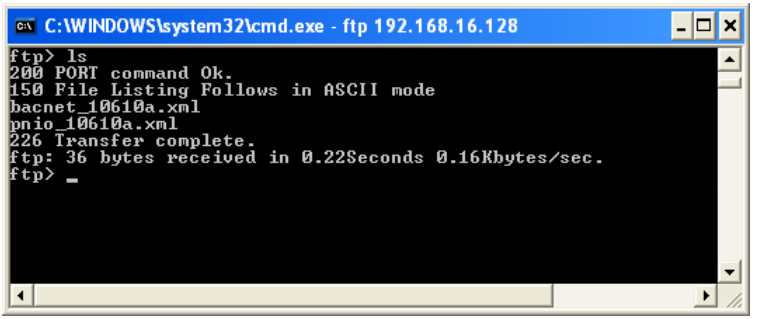


Figure 33: Listing Files With "ls" Command

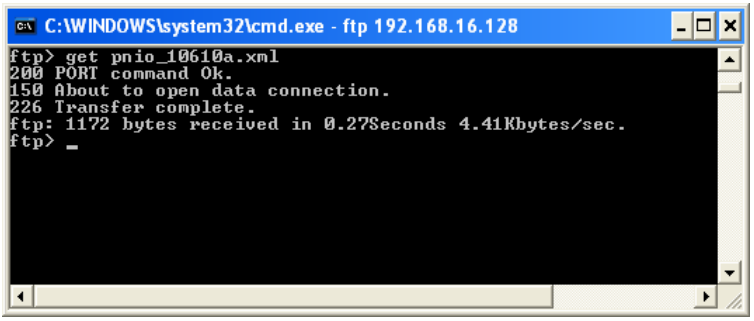


Figure 34: Copying a File From The Unit With "get" Command

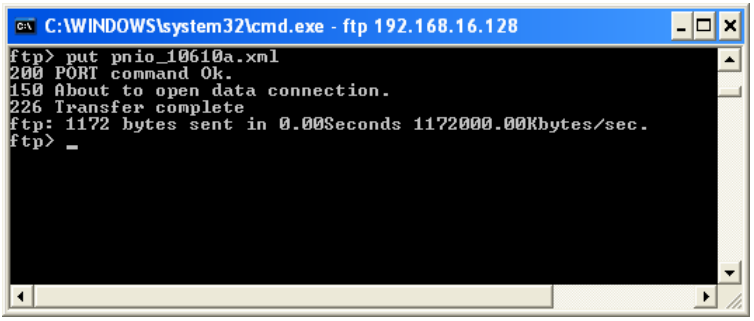


Figure 35: Copying a File To The Unit With "put" Command

11.4 Using FTP With Core FTP LE

Core FTP LE (Lite) is a 3rd-party FTP application that can be downloaded for free from http://www.coreftp.com. Core FTP is just one example of the various commercial and freeware FTP client applications available on the internet.

After installing Core FTP LE, run the program. If the "Site Manager" window (Figure 36) does not automatically open, open it by choosing "File…connect".

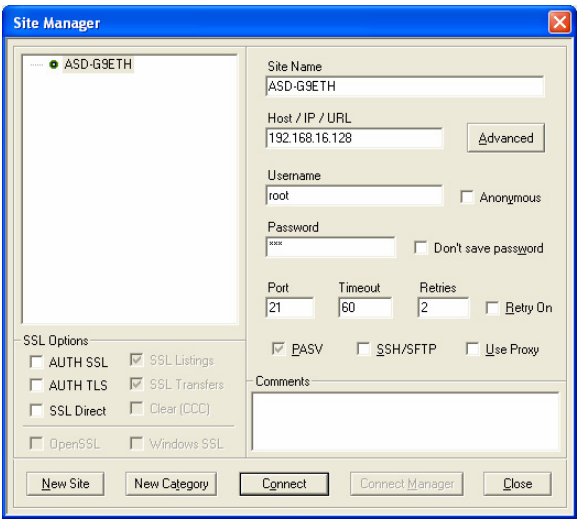


Figure 36: Core FTP Site Manager

Click on the "New Site" button, then enter a Site Name, IP Address, username ("root") and case-sensitive password ("icc"). The "Port", "Timeout", and "Retries" fields should already contain the default values. Click the "Connect" button when done.

Core FTP LE will then try to connect and authenticate to the FTP server, and if successful, will populate the right-hand side of the main page with the unit's filesystem contents. Refer to Figure 37.

Files can be easily downloaded from the unit by choosing the appropriate destination folder on your computer in the left-hand side of the main page, choosing the file to download, and then clicking the "download" button in the right-hand (source) side. Similarly, files can be easily uploaded to the unit by choosing the file to upload and then clicking the "upload" button in the left-hand (source) side of the main page.

Like most 3rd-party FTP client applications, Core FTP LE has a wide array of configuration and file management capabilities, which are beyond the scope of this manual. Refer to the program's Help file for more detailed instructions.

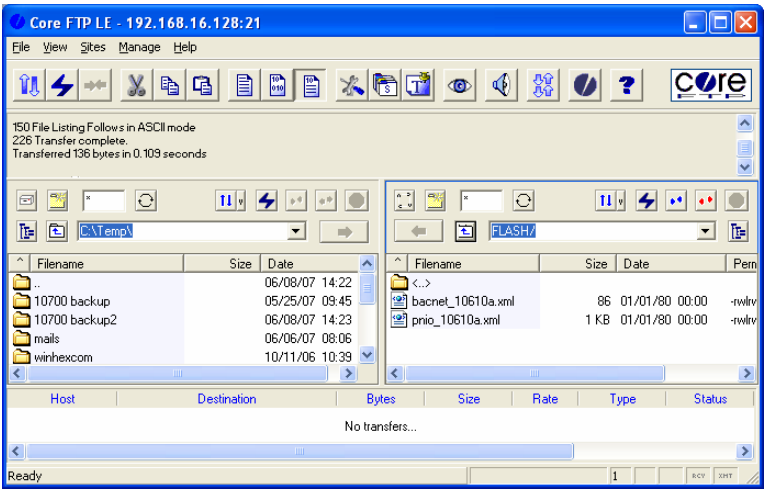


Figure 37: Core FTP In "Connected" State

12. Loading New Application Firmware

The interface card's embedded firmware resides in flash memory that can be updated in the field. Firmware updates may be released for a variety of reasons, such as custom firmware implementations, firmware improvements and added functionality as a result of user requests. Additionally, it may be necessary to load different firmware onto the unit in order to support various protocols (such as Profinet I/O).

ICC is continually striving to enhance the functionality and flexibility of our products, and we therefore periodically release new embedded firmware to achieve these goals and meet customer requests. Flash firmware files and all related documentation (such as updated user manuals) can be downloaded from http://www.iccdesigns.com. It is suggested that users check this Internet site prior to installation, and then periodically afterwards to determine if new firmware has been released and is available to upgrade their units.

Besides the new firmware file, firmware updates require only a PC with the same FTP client capabilities as described in section 11. The new firmware is loaded on the unit via the FTP protocol in the same manner as uploading a configuration (.XML) file. Some notes on uploading new firmware via FTP are:

- Please be sure to read the firmware release notes and updated user's manual for any important notices, behavior precautions or configuration requirements prior to updating your firmware. For example, upgrading to a new firmware version may affect user-defined configuration files: prior to starting an update procedure always back up your configuration file to a PC for later recovery if necessary.
- Because the FTP application firmware in the unit distinguishes application firmware files from XML configuration files by virtue of the filename, don't change the default name of the firmware file to be uploaded to the unit.
- Although the firmware file is uploaded from your PC to the unit in the same manner as configuration files are uploaded, the firmware cannot be downloaded from the unit, because the firmware does not reside in the unit's filesystem like configuration files do.
- After the firmware upload process has been completed (typically requiring 30-45 seconds), the unit will reset automatically 10s after the FTP connection is closed. When the unit boots up again, it will be running the new application firmware, which can be confirmed by observing the version displayed in the web server's information window (refer to section 10.4.1).

13. Protocol-Specific Information

This section will discuss topics that are specific to each of the supported protocols.

13.1 Modbus/TCP

The interface card supports Schneider Electric's Modbus TCP/IP protocol, release 1.0. The interface is conformance class 0 and partial class 1 compliant, and allows up to 200 simultaneous Modbus TCP/IP client connections (sockets). Other notes of interest are:

- The "unit identifier" (UI) field of the request packets must be "1".
- Drive registers are addressed as holding register (4X references). For example, accessing the frequency command involves accessing holding register 41008 (i.e. offset 1008).
- Supported Modbus slave functions are indicated in Table 2.

Table 2: Supported Modbus Slave Functions

Function Code	Function	Modbus TCP/IP Class
3	Read multiple registers	0
6	Write single register	1
16	Write multiple registers	0

- Because the transaction is handled locally within the interface card, write data checking is not available. For example, if a write is performed to a register with a data value that is out-of-range, no Modbus exception will be returned. However, the holding register will always reflect the actual drive data object. In other words, if such an out-of-range write attempt is performed, the unsuccessful write can be observed by later reading the current (unchanged) value of the register during a subsequent Modbus transaction.

13.2 Ethernet/IP

The Ethernet/IP protocol is an application-level protocol implemented on top of the Ethernet TCP/IP and UDP/IP layers. It shares its object model with ControlNet and DeviceNet through the common Control and Information Protocol (CIP). This protocol allows the transfer of data and I/O over Ethernet.

Ethernet/IP incorporates the TCP and UDP layers of the Ethernet protocol in the transmission of data. Because TCP/IP is a point-to-point topology, Ethernet/IP uses this layer only for explicit messaging; i.e. those messages in which the data field carries both protocol information and instructions for service performance. With explicit messaging, nodes must interpret each message, execute the requested task and generate responses. These types of messages can be used to transmit configuration, control and monitor data.

The interface card supports explicit messages from client devices (such as a PLC). The card also provides support for legacy devices (such as PLC5 or SLC PLCs) that only support the PCCC protocol.

- The interface card supports the Ethernet/IP protocol (release 1.0), administered by the Open DeviceNet Vendor Association (ODVA).
- The interface card's product type code is 12 (communications adapter.)
- Supports unconnected messages (UCMM), and up to 32 simultaneous class 3 connections.

The following sections demonstrate specific examples of how to use Ethernet/IP to transfer data between the drive and Allen-Bradley PLCs.

13.2.1 Tag Reference

Register contents are read from and written to the interface card via Ethernet/IP by reference to “Tag Names”. Tags are read via the Ethernet/IP “data table read” service, and tags are written via the Ethernet/IP “data table write” service. Different tags exist for reading vs. writing. Refer to Table 3 and Table 4.

Table 3: Read Tag Reference

Service	Tag Name	Register Start	Length
Data table read	rd_reg_basic	1	100
Data table read	rd_reg_101	101	100
Data table read	rd_reg_201	201	100
Data table read	rd_reg_301	301	100
Data table read	rd_reg_401	401	100
Data table read	rd_reg_501	501	100
Data table read	rd_reg_601	601	100
Data table read	rd_reg_701	701	100
Data table read	rd_reg_801	801	100
Data table read	rd_reg_901	901	100
Data table read	rd_reg_1001	1001	100
Data table read	rd_reg_1201	1201	100
Data table read	rd_reg_1301	1301	100
Data table read	rd_reg_1401	1401	85
Data table read	rd_inv_stat1	1402	1
Data table read	rd_freq_out	1401	1
Data table read	rd_inv_stat2	1443	1
Data table read	rd_torq_out	1419	1

Table 4: Write Tag Reference

Service	Tag Name	Register Start	Length
Data table write	wr_reg_basic	1	100
Data table write	wr_reg_101	101	100
Data table write	wr_reg_201	201	100
Data table write	wr_reg_301	301	100
Data table write	wr_reg_401	401	100
Data table write	wr_reg_501	501	100
Data table write	wr_reg_601	601	100
Data table write	wr_reg_701	701	100
Data table write	wr_reg_801	801	100
Data table write	wr_reg_901	901	100
Data table write	wr_reg_1001	1001	100
Data table write	wr_cmd1	1007	1
Data table write	wr_freq_cmd	1008	1
Data table write	wr_cmd2	1024	1
Data table write	wr_torq_cmd	1034	1

To read data from the interface card, the application PLC program will need to reference a “source element” from which to start reading and the “number of elements” to read. The “source element” will be constructed from one of the tags indicated in Table 3. The “source element” can be either a base tag (such as “rd_reg_1301”, which starts at register 1301), or an offset from a base tag (such as “rd_reg_1301[4]”, which starts at register 1301+4 = register 1305, the drive’s input voltage monitor register).

The “number of elements” to read can be any quantity of registers from 1 to the maximum length of a tag.

In addition to the block tags which provide access to up to 100 registers per block, there are also four discrete read tags which exist. For convenience, these discrete read tags allow direct access to the most commonly-monitored parameters, namely the status word #1, output frequency, status word #2, and the torque value. In the case of output frequency, for example, it does not matter if a request is made to read source element “rd_freq_out”, “rd_reg_1401”, or “rd_reg_1401[0]”: these source elements will all return the drive’s output frequency (register 1401).

In a similar manner, to write data to the interface card, the application PLC program will need to reference a “destination element” to which to start writing and the “number of elements” to write. In this case, the “destination element” will be constructed from one of the tags indicated in Table 4. For convenience, discrete write tags also exist to directly access the drive’s command word #1, frequency command, command word #2 and torque command.

13.2.2 ControlLogix Example: Setup

This section will demonstrate how to initially setup a ControlLogix PLC (such as a 1756-L61) coupled with a 1756-ENBT communications bridge. Later sections will provide specific read/write examples using this configuration. All data in the following examples will be transferred via MSG instructions.

1) Run RSLogix 5000, and create a new configuration.

2) Add a 1756-ENET/B to your I/O configuration.

a) Right click on the I/O Configuration node in the controller organizer view and choose “New Module…”

b) The “Select Module” window will open.

c) Under “Communications”, select “1756-ENET/B”, and click OK. Refer to Figure 38.

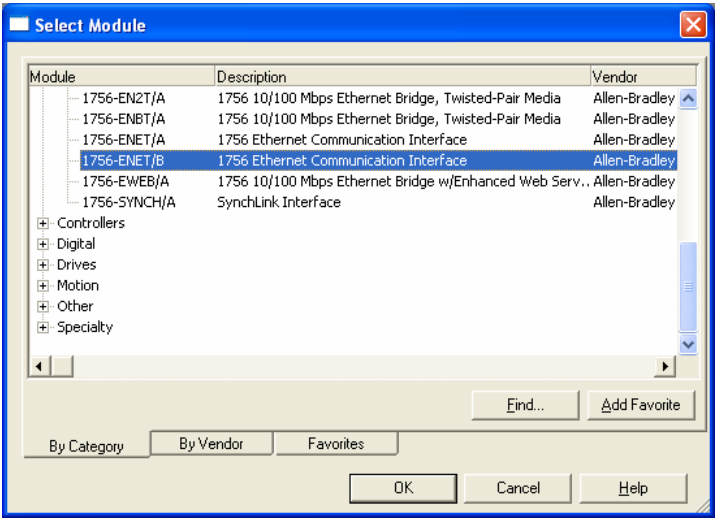


Figure 38: Adding a New Module

d) The “New Module” window will open. Refer to Figure 39.

e) Assign the Ethernet module a name (we will use “EIP”) and an IP address, deselect “Open Module Properties”, and click OK.

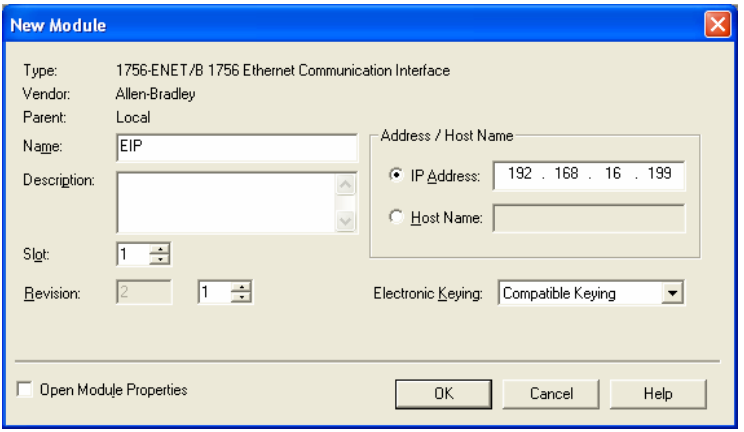


Figure 39: Identifying the New Module

13.2.3 ControlLogix Example: Read a Register Block

This example program will show how to continuously read a block of registers from the drive with a single MSG instruction. Only one read request is outstanding at any given time.

1) Create new Tags.

a) Double click “Controller Tags” in the controller organizer view.

b) The “Controller Tags” window appears. Refer to Figure 40.

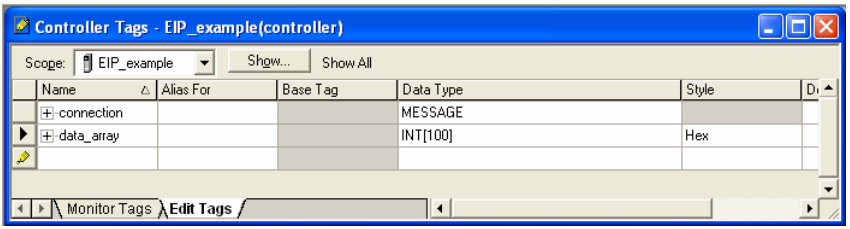


Figure 40: Create New Tags

c) Select the “Edit Tags” tab at the bottom.

d) Create a new tag by entering “connection” in the first blank Name field, and change its Data Type to “MESSAGE”. This tag will contain configuration information for the MSG instruction.

e) Expand the “connection” tag by clicking on the “+” sign next to the tag name. Scroll down to the connection.UnconnectedTimeout field and change its value from the default 30000000 (30s in 1uS increments) to 1000000 (1s). This value determines how long to wait before timing out and retransmitting a connection request if a connection failure occurs. Refer to Figure 41.

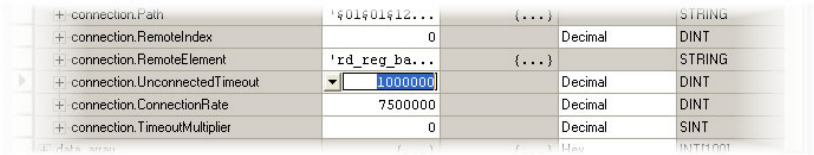


Figure 41: Reduce the UnconnecteTimeout Value

f) Collapse the “connection” tag again by clicking on the “-“ sign next to the tag name.

g) Create another new tag by entering “data_array” in the next blank Name field, and change its Data Type by typing in “INT[100]” in the Data Type field. This tag is an array of INTs that will be able to hold

up to 100 16-bit registers from the drive. Always make sure that the destination tag size is large enough to hold all elements to be read.

2) Add a MSG instruction to the main program.

a) Double click “MainRoutine” under Tasks->MainTask->MainProgram in the controller organizer view.

b) Right click on the first ladder logic rung in the MainRoutine window and select “Add Ladder Element...”

c) The “Add Ladder Element” window appears.

d) Select the “MSG” instruction in the Input/Output folder. Refer to Figure 42.

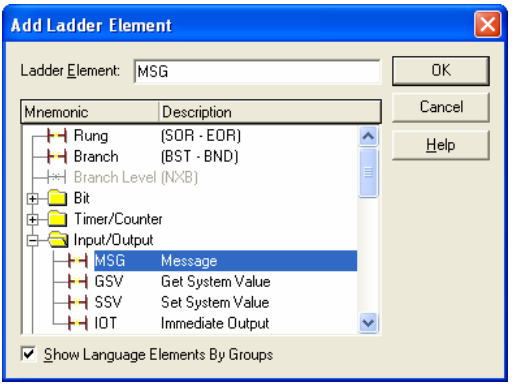


Figure 42: Adding a MSG Instruction

e) Click OK.

3) Add an XIO element to the main program.

a) Right click on the ladder logic rung containing the MSG instruction in the MainRoutine window and select “Add Ladder Element...” again.

b) The “Add Ladder Element” window appears.

c) Select the “XIO” element in the Bit folder. Refer to Figure 43.

d) Click OK.

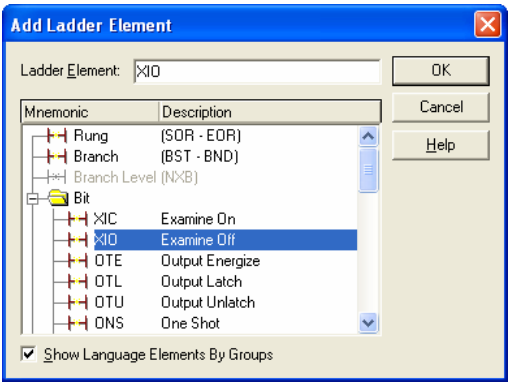


Figure 43: Adding an XIO Element

4) Configure the MSG instruction.

a) Edit the “Message Control” field on the MSG instruction to use the previously-created “connection” tag. Refer to Figure 44.

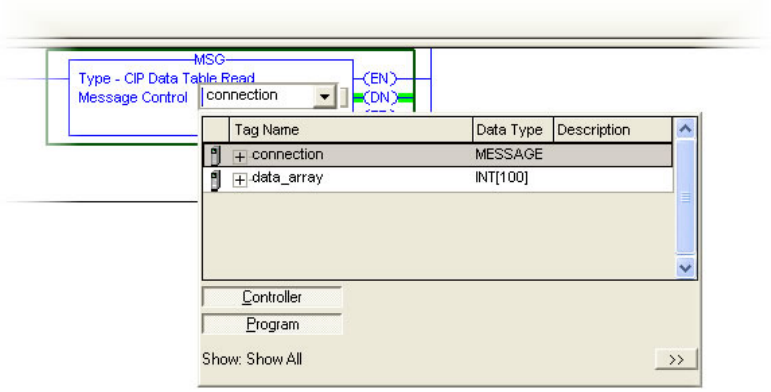


Figure 44: MSG Instruction Tag Assignment

b) Click the message configuration button (“…”) in the MSG instruction. The “Message Configuration” window will open. Refer to Figure 45.

c) “Configuration” tab settings:

i) Change the “Message Type” to “CIP Data Table Read”.

ii) In the "Source Element” field, enter the read tag you wish to access (refer to Table 3.) In this example, we will be reading a total of 25 registers beginning at rd_reg_basic[10]. Offset 10 in

the interface card's rd_reg_basic root tag (which starts at register 1) refers to 1+10 = register 11 (deceleration time 1).

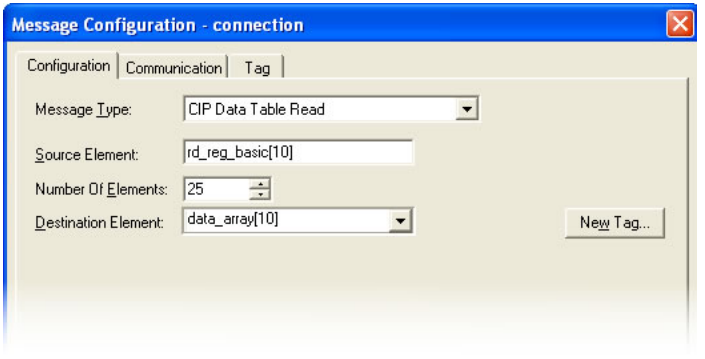


Figure 45: MSG Instruction Configuration

iii) Enter the Number Of Elements to read. In this example, we will read 25 registers.

iv) For the Destination Element, either directly type in "data_array[10]", or select element #10 in the data_array tag via the drop-down box (refer to Figure 46). The destination could be any offset in the data_array tag, as long as the offset plus the Number Of Elements (25) does not exceed the tag size (100).

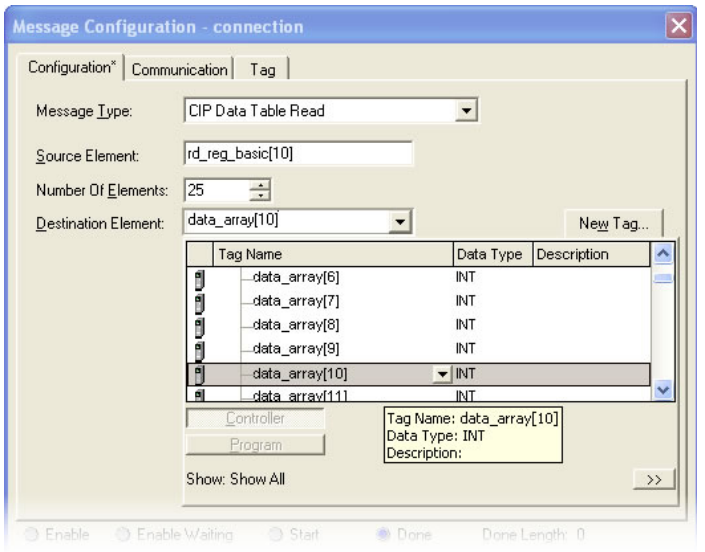


Figure 46: Selecting the Destination Element

d) "Communication" tab settings (refer to Figure 47):

i) Enter the Path to the interface card. A typical path is formatted as "*Local_ENB,2,target_IP_address*", where:

- *Local_ENB* is the name of the 1756-ENBx module in the local chassis,
- *2* is the Ethernet port of the 1756-ENBx module in the local chassis, and
- *target_IP_address* is the IP address of the target node.

In our example, this path would be entered as "EIP,2,192.168.16.128".

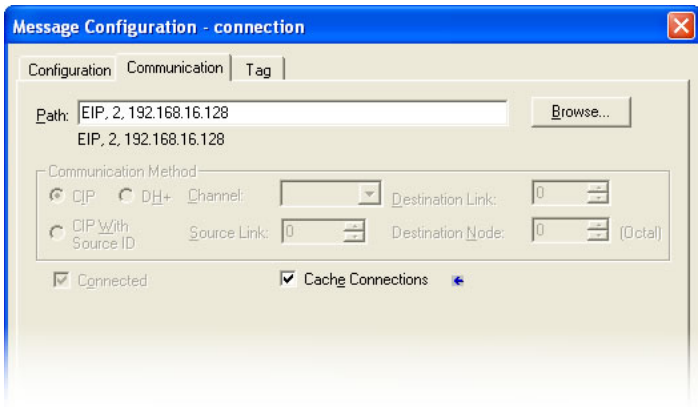


Figure 47: Setting the Communication Path

ii) If "Cache Connections" is enabled (checked), the connection remains open after transmission. If disabled (unchecked), the connection is opened before and closed after every transmission. For efficiency, it is recommended to enable "Cache Connections".

e) Click "OK" to close the MSG Configuration dialog. At this stage, MainRoutine should look like Figure 48.

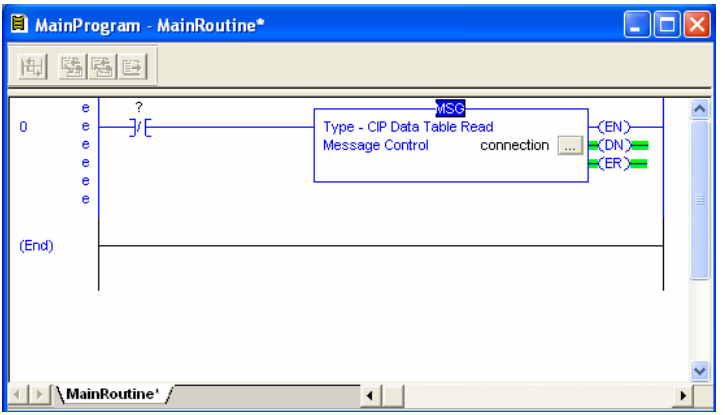


Figure 48: MainRoutine

5) Assign a tag to the XIO element.

a) Double-click on the XIO element located to the left of the MSG block. In the drop-down box, double-click on the “connection.EN” field. Refer to Figure 49. This configuration causes the MSG instruction to automatically retrigger itself when it completes. While this is acceptable for the purposes of this example, it can produce high network utilization. In actual practice, it may be desirable to incorporate additional logic elements to allow triggering the MSG instruction at a specific rate or under specific conditions.

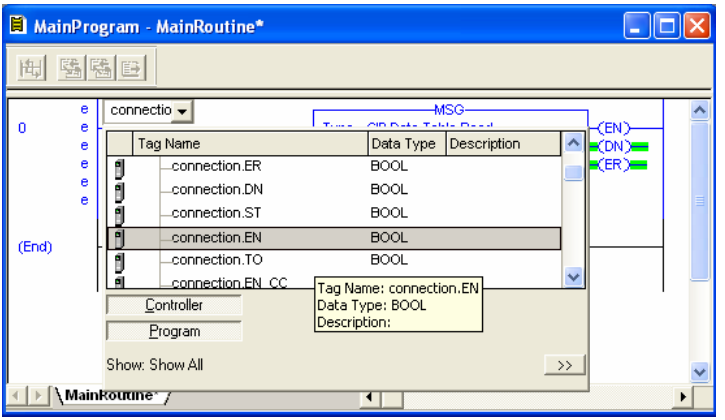


Figure 49: Configure XIO Element

6) The program is now complete. Refer to Figure 50.

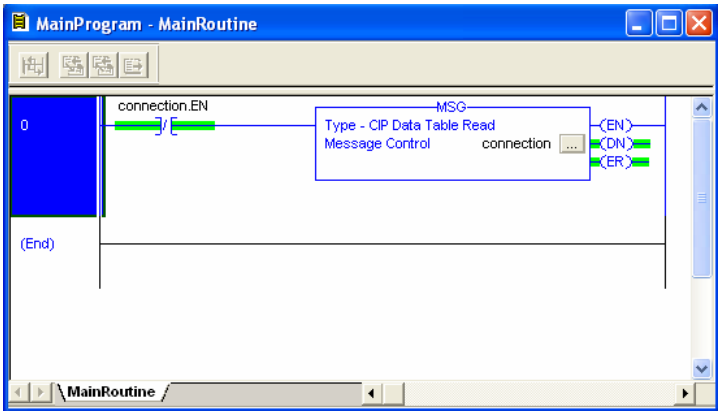
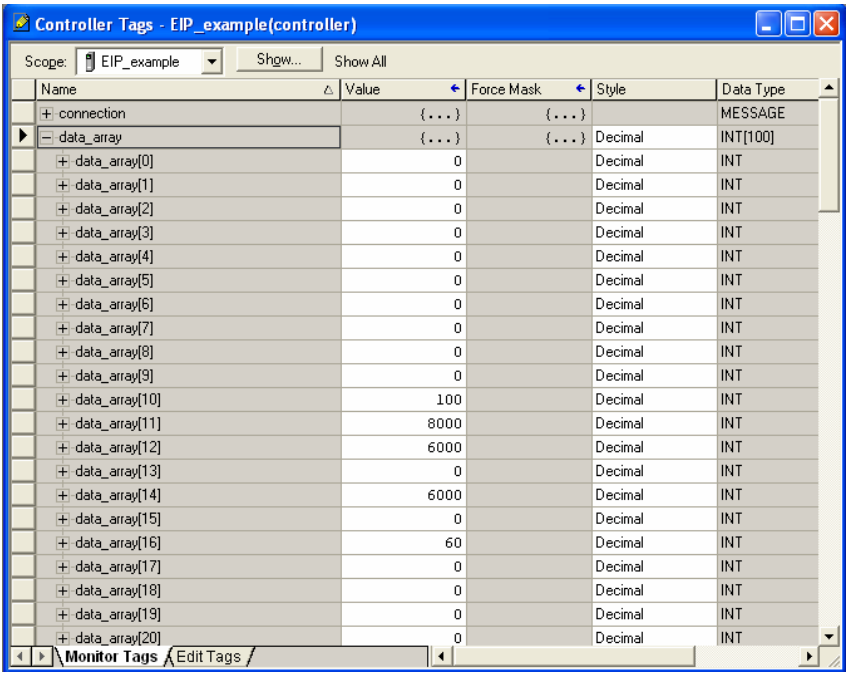


Figure 50: Complete Program

7) Save, download and run the program.

a) To view the values of the registers being read from the interface card, double-click “Controller Tags” in the controller organizer view.



Name	Value	Force Mask	Style	Data Type
connection	{...}	{...}		MESSAGE
data_array	{...}	{...}	Decimal	INT[100]
data_array[0]	0		Decimal	INT
data_array[1]	0		Decimal	INT
data_array[2]	0		Decimal	INT
data_array[3]	0		Decimal	INT
data_array[4]	0		Decimal	INT
data_array[5]	0		Decimal	INT
data_array[6]	0		Decimal	INT
data_array[7]	0		Decimal	INT
data_array[8]	0		Decimal	INT
data_array[9]	0		Decimal	INT
data_array[10]	100		Decimal	INT
data_array[11]	8000		Decimal	INT
data_array[12]	6000		Decimal	INT
data_array[13]	0		Decimal	INT
data_array[14]	6000		Decimal	INT
data_array[15]	0		Decimal	INT
data_array[16]	60		Decimal	INT
data_array[17]	0		Decimal	INT
data_array[18]	0		Decimal	INT
data_array[19]	0		Decimal	INT
data_array[20]	0		Decimal	INT

Figure 51: Viewing the Register Values

b) Select the “Monitor Tags” tab.

c) Expand the data_array tag. Refer to Figure 51.

d) 25 register values starting at register #11 are being continuously read from the interface card and placed in the 25 sequential offsets of data_array starting at the 11th offset (data_array[10]). In Figure 51, we can see that data_array[10] (deceleration time #1) has a value of 100 (10.0s), data_array[11] (maximum frequency) has a value of 8000 (80.00Hz) etc.

13.2.4 ControlLogix Example: Read a Single Register

The configuration and execution for reading a single register is in general identical to that required for reading a block of registers as detailed in section 13.2.3. The only difference is in the configuration of the MSG instruction. Figure 52 shows an example MSG instruction’s Configuration tab, which will read a single tag (rd_inv_stat1), which is the drive’s “inverter status 1” register, and place it in the first element (offset 0) of data_array.

Figure 52: Read the Drive’s Status Register

13.2.5 ControlLogix Example: Multiple MSG Instructions

At times, reading from different groups of registers may be necessary. For example, a specific application may require some registers located in the rd_reg_1301 block tag and some located in the rd_reg_1401 block tag. To accomplish this task, multiple MSG instructions will need to be implemented in the PLC program.

The configuration and execution for implementing multiple MSG instructions is in general identical to that required for implementing just one MSG instruction. Each MSG instruction will require its own message controller tag. In the case

of read MSG instructions, more than one instruction may use the same Destination Element tag, but the storage locations must not overlap. Figure 53 shows an example of two MSG instructions, each accessing different read tags. It is evident from this logic that “rd_connection” and “rd_connection2” are the two independent message controller tags created for these instructions.

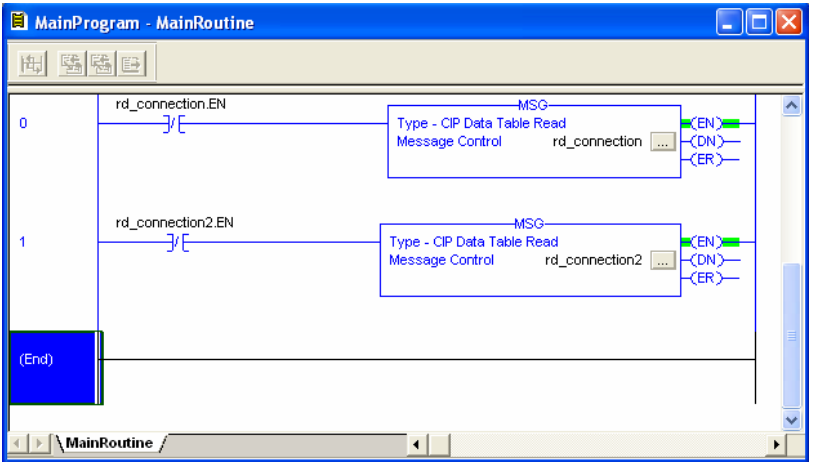


Figure 53: Reading Via Multiple MSG Instructions

13.2.6 ControlLogix Example: Reading and Writing

Often times, applications may need to both read data from and write data to the drive. At a minimum, this will require two MSG instructions and two message controller tags. Figure 54 shows an example of two MSG instructions, one for reading and one for writing. The only item of note that differentiates this example from the multiple-read example in section 13.2.5 is the addition of the en_wr XIC element. The reason for the addition of this element is that while reading from a remote device is often continuously performed (monitoring), data is typically written to the remote device only when necessary (i.e. when the value to write has changed). This conserves both network bandwidth and potentially EEPROM lifespans on the target device. The en_wr element in this example, therefore, would typically be replaced in an actual application program by user-provided logic which controls the conditions under which a write operation would be performed.

Figure 55 shows the configuration details of the example wr_connection MSG instruction. Note that the chosen “Message Type” is “CIP Data Table Write”, and that this instruction will only be writing to one drive register: namely, the frequency command (Destination Element is wr_freq_cmd). Refer to section 13.2.1 for a list of available write tags. The Source Element in this case is the 8th element (starting from index 0) of an INT array tag named “wr_data_array”.

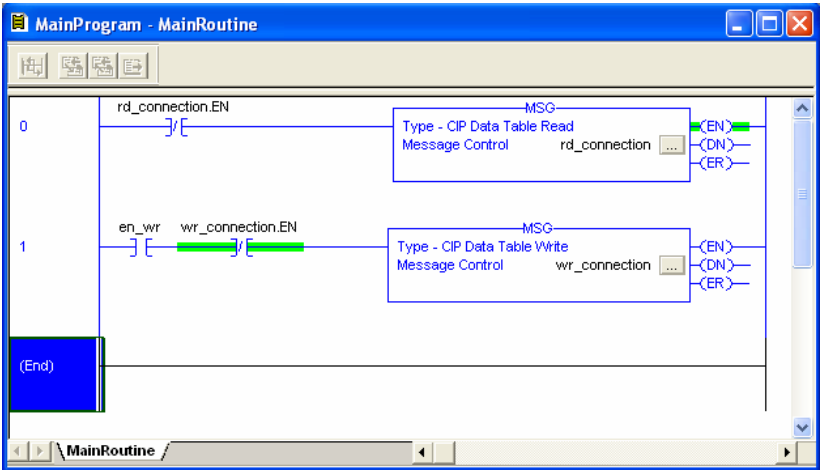


Figure 54: Reading and Writing Via MSG Instructions

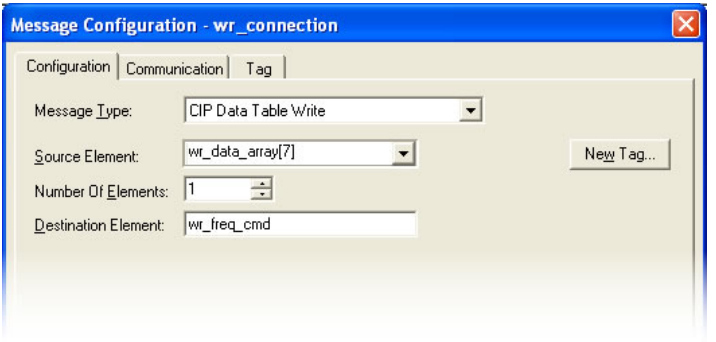


Figure 55: MSG Configuration for Writing

13.2.7 PCCC Programming Example

UNDER CONSTRUCTION

13.3 BACnet

The interface card supports the BACnet/IP (Annex J) protocol over Ethernet via UDP port 47808.

13.3.1 Protocol Implementation Conformance Statement

BACnet Protocol

Date:	March 28, 2007
Vendor Name:	ICC, Inc.
Product Name:	Ethernet interface for Toshiba G9/AS1 ASD
Product Model Number:	ASD-G9ETH
Applications Software Version:	V1.05h (M)
Firmware Revision:	V1.000
BACnet Protocol Revision:	1

Product Description:

The Toshiba G9/AS1 is an advanced inverter featuring reduced high-frequency noise, reduced harmonics, and high-precision and high-speed torque control with or without sensors.

BACnet Standard Device Profile (Annex L):

☐ BACnet Operator Workstation (B-OWS)
☐ BACnet Building Controller (B-BC)
☐ BACnet Advanced Application Controller (B-AAC)
☒ BACnet Application Specific Controller (B-ASC)
☐ BACnet Smart Sensor (B-SS)
☐ BACnet Smart Actuator (B-SA)

BACnet Interoperability Building Blocks Supported (Annex K):

☒ Data Sharing – ReadProperty-B (DS-RP-B)
☒ Data Sharing – ReadPropertyMultiple-B (DS-RPM-B)
☒ Data Sharing – WriteProperty-B (DS-WP-B)
☒ Device Management – Dynamic Device Binding-B (DM-DDB-B)
☒ Device Management – Dynamic Object Binding-B (DM-DOB-B)

Segmentation Capability:

None

☐ Segmented requests supported Window Size _____
☐ Segmented responses supported Window Size _____

Standard Object Types Supported:

See “Object Types/Property Support Table”.

Data Link Layer Options:

☒ BACnet IP, (Annex J)
☐ BACnet IP, (Annex J), Foreign Device
☐ ISO 8802-3, Ethernet (Clause 7)
☐ ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8)
☐ ANSI/ATA 878.1, RS-485 ARCNET (Clause 8), baud rate(s) _____
☐ MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800
☐ MS/TP slave (Clause 9), baud rate(s): _____
☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s): _____
☐ Point-To-Point, modem, (Clause 10), baud rate(s): _____
☐ LonTalk, (Clause 11), medium: _____
☐ Other: _____

Device Address Binding:

Is static device binding supported? (This is currently for two-way communication with MS/TP slaves and certain other devise.) ☐ Yes ☒ No

Networking Options:

☐ Router, Clause 6 - List all routing configurations
☐ Annex H, BACnet Tunneling Router over IP
☐ BACnet/IP Broadcast Management Device (BBMD)
Does the BBMD support registrations by Foreign Devices? ☐ Yes ☐ No

Character Sets Supported:

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

☒ ANSI X3.4	☐ IBM™/Microsoft™ DBCS	☐ ISO 8859-1
☐ ISO 10646 (UCS-2)	☐ ISO 10646 (UCS-4)	☐ JIS C 6226

If this product is a communication gateway, describe the types of non-BACnet equipment/networks(s) that the gateway supports: N/A

Object Types/Property Support Table

The following table summarizes the Object Types/Properties supported.

Property	Object Type				
	Device	Binary Input	Binary Output	Analog Input	Analog Output
Object Identifier	R	R	R	R	R
Object Name	R	R	R	R	R
Object Type	R	R	R	R	R
System Status	R				
Vendor Name	R				
Vendor Identifier	R				
Model Name	R				
Firmware Revision	R				
Appl Software Revision	R				
Protocol Version	R				
Protocol Revision	R				
Services Supported	R				
Object Types Supported	R				
Object List	R				
Max APDU Length	R				
Segmentation Support	R				
APDU Timeout	R				
Number APDU Retries	R				
Max Master					
Max Info Frames					
Device Address Binding	R				
Database Revision	R				
Present Value		R	W	R	W
Status Flags		R	R	R	R
Event State		R	R	R	R
Reliability		R	R	R	R
Out-of-Service		R	R	R	R
Units				R	R
Priority Array			R		R
Relinquish Default			R		R
Polarity		R	R		
Active Text		R	R		
Inactive Text		R	R		

R – readable using BACnet services
W – readable and writable using BACnet services

13.3.2 Supported Objects

Binary Input Object Instance Summary

Instance ID	Object Name	Description	Active/ Inactive Text
BI1	RUN_STOP_STATUS	Run/stop status	running/ stopped
BI2	FWD_REV_STATUS	Forward/reverse status	reverse/ forward
BI3	F_PIT_STATUS	"F" programmable input terminal status	on/off
BI4	R_PIT_STATUS	"R" programmable input terminal status	on/off
BI5	ST_PIT_STATUS	"ST" programmable input terminal status	on/off
BI6	RES_PIT_STATUS	"RES" programmable input terminal status	on/off
BI7	S1_PIT_STATUS	"S1" programmable input terminal status	on/off
BI8	S2_PIT_STATUS	"S2" programmable input terminal status	on/off
BI9	S3_PIT_STATUS	"S3" programmable input terminal status	on/off
BI10	S4_PIT_STATUS	"FS4" programmable input terminal status	on/off
BI11	OUT1_POT_STATUS	"OUT1" programmable input terminal status	on/off
BI12	OUT2_POT_STATUS	"OUT2" programmable input terminal status	on/off
BI13	FL_POT_STATUS	"FL" programmable input terminal status	on/off

Binary Output Object Instance Summary

Instance ID	Object Name	Description	Active/ Inactive Text
BO1	RUN_STOP_CMD	Run/stop command	run/stop
BO2	FWD_REV_SEL	Forward/reverse command	reverse/forward
BO3	EMERGENCY_OFF	Emergency off command	emergency off/ no action
BO4	FAULT_RESET	Fault reset command	reset/no action
BO5	FEEDBACK_CTRL_SEL	Feedback enable/ disable selection	enable/disable
BO6	FREQ_PRIORITY	Frequency priority	on/off
BO7	COMMAND_PRIORITY	Command priority	on/off
BO8	DATA_OUT1_TERMINAL	Output terminal “selected data out 1”	on/off
BO9	DATA_OUT2_TERMINAL	Output terminal “selected data out 2”	on/off
BO10	DATA_OUT3_TERMINAL	Output terminal “selected data out 3”	on/off

Analog Input Object Instance Summary

Instance ID	Object Name	Description	Units
AI1	OUTPUT_FREQ	Output frequency	Hz
AI2	LOAD_CURRENT	Output current	Percent
AI3	OUTPUT_VOLTAGE	Output voltage	Percent
AI4	INPUT_POWER_CONSUME	Input power	KW
AI5	RR_ANALOG_INPUT	RR/S4 input	Percent
AI6	VI_II_ANALOG_INPUT	VI/II input	Percent
AI7	RX_ANALOG_INPUT	RX input	Percent
AI8	TRIP_CODE	Trip code information	None

Analog Output Object Instance Summary

Instance ID	Object Name	Description	Units
AO1	FREQ_CMD_REG	Frequency command	Hz
AO2	FM_ANALOG OUTPUT	FM output value	None
AO3	AM_ANALOG OUTPUT	AM output value	None

13.3.3 Supported Object Details

Binary Input Objects

BI1 ..... Indicates whether the drive is running or stopped. ASD parameter FE01, bit#10.

BI2 ..... Indicates whether the drive is running in the forward or reverse direction. ASD parameter FE01, bit #9.

BI3 ..... Indicates the status of the "F" programmable input terminal. ASD parameter FE06, bit#0.

BI4 ..... Indicates the status of the "R" programmable input terminal. ASD parameter FE06, bit#1.

BI5 ..... Indicates the status of the "ST" programmable input terminal. ASD parameter FE06, bit#2.

BI6 ..... Indicates the status of the "RES" programmable input terminal. ASD parameter FE06, bit#3.

BI7 ..... Indicates the status of the "S1" programmable input terminal. ASD parameter FE06, bit#4.

BI8 ..... Indicates the status of the "S2" programmable input terminal. ASD parameter FE06, bit#5.

BI9 ..... Indicates the status of the "S3" programmable input terminal. ASD parameter FE06, bit#6.

BI10 ..... Indicates the status of the "S4" programmable input terminal. ASD parameter FE06, bit#7.

BI11 ..... Indicates the status of the "OUT1" programmable output terminal. ASD parameter FE07, bit#0.

BI12 ..... Indicates the status of the "OUT2" programmable output terminal. ASD parameter FE07, bit#1.

BI13 ..... Indicates the status of the "FL" programmable output terminal. ASD parameter FE07, bit#2.

Binary Output Objects

Note that the drive will only use the commands indicated in BO1, BO2 and BO5 if the *Command Mode* parameter is set to "Communication Interface Input Enabled", or if the "command override" bit (BO7) is ON.

BO1 ..... Run/stop command. ASD parameter FA06, bit#10.

BO2 ..... Forward/reverse command. ASD parameter FA06, bit#9.

BO3 ..... Forces the drive to fault "Emergency Off". ASD parameter FA06, bit#12.

BO4 ..... Resets the drive when it is faulted. ASD parameter FA06, bit#13.

BO5 ..... Enables or disables process (PID) feedback control. Note that this object does not activate (turn on) feedback control. It only enables or disables feedback control once it has already been activated. ASD parameter FA06, bit#5.

BO6 ..... Communication interface frequency priority selection. Allows the frequency command from the interface card to be used by the drive without having to set the *Frequency Mode* parameter. Refer to the Toshiba documentation regarding "Command Mode and Frequency Mode Control" for detailed information pertaining to the frequency source hierarchy and the use of overrides. ASD parameter FA06, bit#14.

BO7 ..... Communication interface command priority selection. Allows commands (BO1, BO2, and BO5) from the interface card to be used by the drive without having to explicitly set the *Command Mode* parameter. Refer to the Toshiba documentation regarding "Command Mode and Frequency Mode Control" for detailed information pertaining to the command source hierarchy and the use of overrides. ASD parameter FA06, bit#5.

BO8 ..... Output terminal data out 1. Any programmable output terminals that are configured to output “specified data output 1” will follow the value of this BO. ASD parameter FA50, bit#0.

BO9 ..... Output terminal data out 2. Any programmable output terminals that are configured to output “specified data output 2” will follow the value of this BO. ASD parameter FA50, bit#1.

BO10 .... Output terminal data out 3. Any programmable output terminals that are configured to output “specified data output 3” will follow the value of this BO. ASD parameter FA50, bit#2.

Analog Input Objects

AI1 ..... Output frequency in 0.01Hz units. ASD parameter FD00.

AI2 ..... Load current in 0.01% units (10000=100.00%=drive's rated current). ASD parameter FE03.

AI3 ..... Output voltage in 0.01% units (10000=100.00%=drive's rated voltage). ASD parameter FE05.

AI4 ..... Input power consumption (drive+motor) in 0.01kW units. ASD parameter FE29.

AI5 ..... Indicates the signal level currently being applied to the ASD's RR analog input terminal. This can be used to monitor such items as feedback sensor outputs and other process variables. Expressed in 0.01% units (10000=100.00%=input rated value). ASD parameter FE35.

AI6 ..... Similar to AI5, this object indicates the signal level currently being applied to the ASD's VI/II analog input terminal. ASD parameter FE36.

AI7 ..... Similar to AI5, this object indicates the signal level currently being applied to the ASD's RX analog input terminal. ASD parameter FE37.

AI8 ..... Indicates the present fault code. Under normal operation (no faults), this value will be 0. ASD parameter FC90.

Analog Output Objects

AO1 ..... Sets the drive's frequency command in 0.01Hz units (e.g. 4000 = 40.00Hz). Note that the drive will only use this value as its active frequency command if the *Frequency Mode* parameter is set to "Communication Option Input Enabled ", or if the "frequency override" bit (BO6) is ON. Although the adjustment range for this object is 0-40000 (0.00Hz-400.00Hz), the actual frequency command will be internally limited by the *Upper Limit Frequency* and *Lower Limit Frequency* parameters. ASD parameter FA07.

AO2 ..... Adjusts the FM analog output voltage if the "FM terminal meter selection" parameter is set to a value of 31 (communication data output). Range is 0-2047 = 0-100%. ASD parameter FA51.

AO3 ..... Adjusts the AM analog output voltage if the "AM terminal meter selection" parameter is set to a value of 31 (communication data output). Range is 0-2047 = 0-100%. ASD parameter FA52.

INDUSTRIAL CONTROL COMMUNICATIONS, INC.

Madison Office
1600 Aspen Commons, Suite 210
Middleton, WI USA 53562-4720
Tel: [608] 831-1255 Fax: [608] 831-2045

Houston Office
12300 Dundee Court, Suite 212
Cypress, TX USA 77429-8364

http://www.iccdesigns.com

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